2017 University of California Combined Research and Extension Annual Report of Accomplishments and Results

Status: Accepted

Date Accepted: 08/23/2018

I. Report Overview

1. Executive Summary

The University of California Division of Agriculture and Natural Resources (UC ANR) is the major land grant arm for the university and the state, as part of the nationwide public university system "built on behalf of the people" (Abraham Lincoln). The Agricultural Experiment Station (AES) was established to develop cutting-edge research information that can be applied to solving real-world problems in agriculture and natural resources. Cooperative Extension (CE) was created as a cadre of academics located in local communities to translate and test research findings for practical, local solutions. UC ANR is unique in its three-way partnership with federal, state, and county governments to provide these local and statewide research and extension programs that address the critical issues of California. Through its partnerships and collaborations, UC ANR is able to leverage its resources to increase its ability to address these issues.

UC ANR's mission is to engage UC with the people of California to achieve innovation in fundamental and applied research and education that supports:

- sustainable, safe, and nutritious food production and delivery
- economic success in a global economy
- a sustainable, healthy, productive environment
- science literacy and youth development programs.

Agricultural Experiment Station (AES) faculty members conduct research and teach in three colleges and one professional school on the Davis, Berkeley, and Riverside campuses. The AES has approximately 580 academic researchers, most of whom also have professorial appointments representing dozens of scientific disciplines. Cooperative Extension is the principal outreach arm of the Division with academic appointees located across the state on campuses, Research and Extension Centers (RECs), and in counties. There are approximately 115 CE specialists and 170 CE advisors conducting research, outreach, and education. The CE specialists are located in departments on the Berkeley, Davis, Riverside, and, more recently, Merced and Santa Barbara campuses, as well as at RECs and county offices. The CE advisors are located in county-based offices and at RECs. The nine RECs, located in a variety of ecosystems across the state, provide a core research and extension base. In addition, eight statewide programs and two statewide institutes focus on specific issues that engage UC ANR academics and UC faculty from all the other campuses, allowing integrated teams to work on complex issues that need multidisciplinary approaches.

FY 2017
UC ANR continued to make significant progress toward its Strategic Vision 2025 through the implementation of the ANR Strategic Plan 2016-2020, which was developed to further operationalize the vision. The plan identified five strategic objectives: 1) advance and encourage forward-thinking, science-based solutions through discovery and engagement with Californians to address local issues with global impact; 2) attract, develop, and retain diverse, highly productive, talented, and motivated people who seek a mission-driven experience; 3) develop a sustainable, diverse revenue model with efficient administration to support UC ANR's mission; 4) optimize delivery of programs and services through best management

practices with efficiency, transparency, and integrity; and 5) communicate the value of UC ANR to the UC community, our partners, and the people of California. There are fifteen goals with specific key strategies and metrics with targets to realize these strategic objectives. Of particular relevance to federal reporting is Goal 5: prioritize programs and services, which convened academics across program areas to develop division-wide public value statements and to identify the condition changes that ANR is best positioned division-wide to contribute to these long-term societal, environmental and economic changes. In FY 2017, these were still under development; they will be shared in the FY 2018 report as a framework for ANR to articulate its accomplishments and public value.

UC ANR continues the commitment to hire in order to exceed projected turnover, thus achieving the goal of academic growth. Since the beginning of 2012, ANR has hired 175 academics (including CE advisors, CE specialists, as well as academic coordinators and administrators and project scientists). During FY 2017, six CE specialists and sixteen CE advisors were hired. Additionally, there were over 23 approved CE academic recruitments that remain to be filled.

During FY 2017, UC ANR solicited a fifth call for proposals for the ANR Competitive Grants Program. This program continues to invest in short-term, high-impact research, education and outreach projects that address high-priority issues that are consistent with the Strategic Vision; encourage collaboration among academics; strengthen the research-extension network; and demonstrate relevance and likelihood of impact on significant agricultural, economic, environmental and social issues in California. Outcomes from these projects are highlighted in this report. In addition in FY 2017, UC ANR launched three new additional funding opportunities. First, the High-Risk/High-Reward Grants Program provides funds (no more than $100,000) to initiate and complete research and proof-of-concept efforts. These projects, if successful, lend themselves to subsequent larger funding opportunities and/or intellectual property development. Decisions about FY 2017 RFPs for both the Competitive Grants and the High-Risk/High/Reward Grants Programs were made in FY 2018. The second new funding opportunity, the Opportunity Grants Program, provides small amounts of resources (no more than $10,000) to initiate and complete critical short-term research, outreach or training efforts. These projects must be time-sensitive in nature and take advantage of a unique opportunity where a small pilot project to collect initial data or an immediate, crucial outreach effort must take place in a timely manner to address an issue of importance. In FY 2017, there were four funded projects. Third, the Matching Grants Program provides cash resources to develop and submit for external funding support of research, outreach or training efforts in response to requests for proposals from a grantor that stipulates a matching funds requirement. The first two projects were funded in FY 2018.

In FY 2017 UC ANR evaluated the three-year pilot program for Graduate Training in Cooperative Extension, which was designed to train and recruit the next generation of CE specialists and CE advisors. The program partners UC Berkeley College of Natural Resources students with CE specialists and CE advisors as mentors to carry out extension-based projects that link to CE research through a competitive process. There were four cohorts with twenty students who were partnered with 46 CE mentors, 10 AES faculty and three other professors. Their projects covered a wide variety of topics, including beneficial insects, forests, mapping for agricultural extension, private land management, wetlands, climate research, invasive plant species, fire management, farm to school programs, and conservation easements. During the pilot there were the following collaborative Extension activities: 25 meetings were coordinated (e.g. classes, demos, field days, etc.) for 462 participants; 42 educational presentations were given for 4,458 participants; 63 other activities were conducted including website posting and development, blogging, social media messaging, and external collaborations; 10 radio/media/press interviews; and 16 publications. Here are a few examples of the students' reflections on the benefits of the program: much more likely to pursue a career in CE; learned about the important role of CE advisors in connecting to local communities; and used this opportunity to establish long-term relationships. The evaluation survey captured the pilot strengths which include: fills major need and gap in training: allows graduates to explore CE and if it is the right fit; gives Advisors access to graduate students; enhances the UC ANR network between campuses and counties; is an alternative pathway for graduate students to develop applied and

practical knowledge and skills; increases the visibility of UCCE; and helps students understand stakeholder needs.

UC ANR continued work on the following five multidisciplinary, integrated initiatives: 1) Healthy Families and Communities; 2) Sustainable Natural Ecosystems; 3) Endemic and Invasive Pests and Diseases; 4) Sustainable Food Systems; and 5) Water Quality, Quantity, and Security. In addition, the Strategic Vision 2025 identifies an "initiative to improve energy security and green technologies through innovative science linking engineering, agricultural, biological, and environmental sciences." Although this is not officially launched as one of UC ANR's five Strategic Initiatives, the Division continues to work on this high priority area and knowing NIFA's interest in this area we continue to report separately on the Federal Planned Program Sustainable Energy.

For FY 2017, California reports on the following six Federal Planned Programs:

1. Healthy Families and Communities
2. Sustainable Food Systems
3. Endemic and Invasive Pests
4. Sustainable Natural Ecosystems
5. Water Quality, Quantity, and Security
6. Sustainable Energy

The following narratives describe the FY 2017 program highlights for these Federal Planned Programs.

Healthy Families and Communities

California faces several critical challenges in the area of human and community development. Nearly one-third of California's school children are overweight or obese, and according to the Centers for Disease Control, low-income and ethnic minority children are at especially high risk. At the same time, many California households are food insecure, having limited or uncertain access to adequate food. Another challenge is that each year approximately 80,000 California youth do not graduate from high school and approximately one of every six 16-24 year-olds in the state is out of school and out of work. Promoting healthy pathways to college and work are urgent concerns, not only for individual youth and their families but also for the state's effort to remain economically competitive in the global economy.

UC ANR's Healthy Families and Communities Strategic Initiative and Federal Planned Program addresses critical issues in the areas of healthy lifestyles, youth development, youth science literacy, and community development. It focuses on promoting healthy behaviors for childhood obesity prevention, encouraging and enhancing youth science literacy, and promoting positive youth development.

During FY2017, 57 Hatch projects were conducted by investigators at UC Riverside, Davis, and Berkeley. CE specialists worked on 19 research and extension projects. CE advisors worked on 233 extension projects and led an additional 27 research projects under the Federal Planned Program Healthy Families and Communities. The following illustrates the breadth of work and includes selected examples highlighting accomplishments in this program area.

Healthy Lifestyles

In California, poor diet and a lack of physical activity are second only to tobacco use as the leading cause of chronic disease and death. Intervention and prevention efforts point to the importance of multifaceted approaches that include both children and parents. Five components help to address these concerns: 1) nutrition education and promotion, 2) family and community partnerships, 3) integration of regional agriculture, 4) foods available on the school campus and 5) school wellness policies. Highlighted examples of UC ANR advances include:

• A project on healthy lifestyle education in schools integrates four program components based on evidence of effective methods for promoting student health and preventing obesity in the school setting. The components are: nutrition education and promotion; family and community partnerships; food available on the school campus featuring regionally procured produce; and school wellness committees and policies. The work has addressed a gap in the field through providing the research needed to document student outcomes and school-site changes resulting from a multi-component, interdisciplinary approach. The results from the intervention have provided an evidence base for state and nationwide dissemination of a tested, integrated, school-based multidisciplinary program that will help reduce the high prevalence of childhood obesity.

• Butte County Cluster has partnered two nutrition programs (UC CalFresh and EFNEP) to deliver programming to a 100-unit Migrant Farm Housing facility. The eight-week program was delivered to mothers and their children living in the migrant farm housing community using the unit Eating Smart, Being Active (adults) and Happy Healthy Me (youth). 78% reported eating more fruits, 22% reported eating more vegetables, and 44% reported increases in their physical activity levels. Other noted changes included: decreasing the consumption of sugar sweetened beverages and checking the nutrition facts labels on prepackaged foods.

• One project is conducting research to develop a comprehensive understanding of the chemistry of food as a way to understand the impact of contemporary agronomic and post-harvest processing techniques have on food quality and chemical safety. The project has resulted in new strategies and processing innovations for retaining and optimizing levels of health beneficial compounds in finished food products, and decreasing the formulation of toxic or undesirable compounds in processed foods. The project has provided new methods for identifying the composition of a wide array of bioactive compounds that significantly contribute to the nutritional quality of foods. Optimizing the quality of fresh and processed foods is key to ensuring the health of Californians.

Youth Development

Positive youth development occurs through an intentional process that provides opportunities, choices, relationships, and the support necessary for youth to fully reach their potential. 4-H's unique role in youth development is based on scientifically valid research. California 4-H analyzes and documents the program's efforts to demonstrate an impact on youth and then disseminate findings to further the field of youth development, to anticipate problems, and to develop practical solutions in the communities served. Highlighted examples of UC ANR advances include:

• National and state agencies have identified biosecurity related to animal agriculture as a matter of high priority and the USDA has a long-term goal of safeguarding the animal production industry from outbreaks of animal disease. Many 4-H Animal Science projects are kept as part of backyard farms. A California 4-H study of youth revealed the presence of numerous biosecurity risks (e.g., being housed in backyard herds with mixed species. Youth from a 4-H club in Santa Cruz County participated in a "Mitigating Zoonotic and Animal Disease Risks in 4-H Animal Science Projects." First, they focused on education about biosecurity and disease risk. Second, they applied learned biosecurity practices at fairs and exhibitions. Third, fecal load assessments were taken at home and fairs to compare the practices of youth receiving education compared to those who did not. Finally, the youth identified the risks associated with fecal pathogen loads measured in animal samples collected at the fair and developed biosecurity best-management practices for youth exhibitors. One practice included addressing a poor drainage of livestock wash stalls located in an area that was highly accessible to vehicles, strollers, fair-goers and food delivery. This and other findings were presented to the fair board where action was taken.

• A project used Lesson Study to advance staff and volunteer professional development in 4-H. The project coordinated a national rollout of Lesson Study through 10 Land Grant Universities. 4-H educators

involved in the four-state pilot test improved teaching practice, content knowledge, lesson planning, lesson delivery, and social connections. These results parallel the literature related to improvements shown by classroom teachers who use lesson study as a professional development model. (Smith, Martin)

- Contra Costa County's Children, Youth and Families at Risk (CYFAR) program used positive youth development practices, youth adult partnerships and evidence-based curriculum to provide teens with healthy living programming, leadership and service learning opportunities. Teens were recruited to participate in a semester-long culinary program to develop leadership, public speaking, and culinary skills while gaining nutrition knowledge and an appreciation for healthy food. The teens reported positive changes in their eating habits, their school attendance and performance. They also shared how the program kept them out of trouble.

Sustainable Food Systems

Projected population growth, widespread poverty, acute water issues, and declining agricultural productivity within the context of climate change create an urgency to increase food production in ways that are more efficient and sustainable in our nation, as well as across the world. California has been an innovative leader in food production for more than a century. California is a major producer of vegetables, fruits, nuts (nearly 50% of the nation's supply), and dairy products (more than 20% of the nation's supply). These are healthy and under-consumed sources of nutrition. More than 400 commodities are produced in the state. California agriculture faces unprecedented challenges to its sustainability, including climate change, water constraints (quantity and quality), regulation, labor, invasive species, urbanization, and other factors.

UC ANR's Sustainable Food Systems Strategic Initiative and Federal Planned Program's research and extension efforts demonstrate breadth and depth of expertise and innovation in urban agriculture and local/regional food systems, specialty crops, plant production and genetics, animal welfare and production management systems, and precision agriculture.

During FY 2017, 196 Hatch and Multistate Research projects were conducted by investigators at UC Riverside, Davis, and Berkeley. CE specialists worked on 63 research and extension projects. CE advisors worked on 528 extension projects and led an additional 103 research projects under the Federal Planned Program Sustainable Food Systems. The following illustrates the breadth of work and includes selected examples highlighting accomplishments in this program area.

Food Access and Diversity in the Food System

The public's interest in agriculture and where their food comes from has grown exponentially over the last several years in California and the United States, especially among urban populations. This interest has led to an increased demand for research and extension programs that support a new and more diverse clientele through urban agriculture and local/regional food systems programs. Highlighted examples of UC ANR advances include:

- One project examined how Hmong refugee smallholder farmers are experiencing the drought, and the strategies they are using to respond to the reduction in groundwater availability. The degree to which this group of farmers is able to access drought relief programs was also evaluated through 71 telephone interviews with Southeast Asian smallholder farmers in Fresno County. Findings indicate Hmong farmers are disproportionately negatively affected by the drought, relative to their more capitalized, land owning neighbors, and they have very little awareness of drought relief programs for which they are eligible. This project resulted in increased knowledge and awareness about the challenges Hmong farmers face accessing drought relief programs and, as a result, several Hmong farmers were assisted in accessing CDFA's State Water Efficiency and Enhancement Program (SWEEP).
- Tribal populations across the country experience high rates of food insecurity and diseases

associated with loss of traditional diet, sedentary lifestyles, degradation of natural resources, and poverty. A USDA-AFRI food security project continued as the Klamath Basin Tribal Food Security Project and has resulted in countless outcomes related to tribal health and food security among the Karuk, Yurok and Klamath Tribes: increased knowledge, capacity, and confidence to manage, gather, grow, prepare, preserve and consume nutritious, fresh, local and traditional food, and a determination to address identified policy barriers, enabling transformation of the food system moving forward. Community-driven outreach and hands-on educational opportunities were provided primarily by the 15 Tribal staff trained through this project. Stakeholders learned new skills focused on subsistence food provisioning, including cooking, gardening, canning, butchering, fruit tree pruning, bread baking, acorn processing, and chicken tractor fabrication, among others. In Year 5 of this project, activities reached a record 6,994 participants, the majority of them Native. In a recent Basin-wide evaluation, 77% of respondents said they had learned something new; 67% had tried out new skills at home; 64% of respondents said they felt the community is more food secure; and 77% said the programs have changed the community in other positive ways. A central focus on engaging youth and developing STEM skills reached a record 4,743 youth. All three tribes have leveraged project successes, securing nearly $2M for ongoing and expanded youth and community programming, and over $1.4M for ecological research.

Specialty Crops

Californians produce more than 400 commodities with specialty crops including fruits and vegetables, tree nuts, and dried fruits contributing significantly to the economy. The diverse California environmental and climatic conditions allow for the production of many high value specialty crops in which California is the production leader. Highlighted examples of UC ANR advances include:

- A series of projects on precision technologies for specialty crop production (almond and grape) - some using wireless sensor networks - has had positive economic and environmental impacts, through reduced water usage, and more precise application of inputs to enhance crop yields. Development of these methods is critical in providing producers with tools that allow them to make informed irrigation decisions for greatest water use efficiency while maintaining productivity.
- Deficit irrigation and efficient nitrogen fertilization during the tree growth phase combined with selective pruning techniques in densely planted almond orchards have demonstrated improvements in canopy management. In addition to providing canopy management benefits, deficit irrigation management may make the orchards less susceptible to insect and/or fungal pests. Employing these techniques would provide direct benefits to growers by decreasing costs of production and reducing potential for worker and environmental pesticide exposure while producing products with the lower pesticide residues for consumers.

Plant Production and Genetics

Challenges in the form of declining agricultural productivity within the context of climate change, water constraints (quantity and quality), regulation, invasive species, and other factors create an urgency to increase food production in ways that are more efficient and sustainable. To meet these challenges, advanced genetic resources and more sustainable production practices must be identified and integrated into commercial agriculture. Highlighted examples of UC ANR advances include:

- One project focuses on the conservation of tomato germplasm, including mutants, wild relatives, and other miscellaneous stocks, maintained by the C.M. Rick Tomato Genetics Resource Center. The Center acquired 141 new accessions this year, including a relatively large collection of S. pimpinellifolium, cherry tomatoes and landraces from Peru, Ecuador, and Mexico. The current total of number of active accessions is 3,912. A total of 2,656 seed samples representing 1,423 unique accessions were distributed in response to 160 requests from 136 researchers and breeders in 18 countries. Feedback provided by recipients indicates the stocks continue to be used to support a wide variety of research and breeding projects.

• The wheat breeding and genetics project continues to develop and evaluate common and durum wheat lines through regional variety trials for agronomic traits, quality characteristics, and disease resistance. Breeder seed of the new hard white spring wheat UC1743 (Patwin 515-HP) was delivered to the Foundation Seed Program to produce Foundation seed in the 2016 cycle. This is an improved version of Patwin 515 that includes the high-grain protein content GPC-B1 and the partial resistance genes Yr36 against stripe rust to reinforce the resistance conferred by the Yr5-Yr15 genes.

• Assessment of Plant Fertility and Fertilizer Requirements for Agricultural Crops in California is an effort to consolidate science-based information at a single website (https://apps1.cdfa.ca.gov/FertilizerResearch/docs/Guidelines.html) that allows growers and crop consultants to manage fertilizers more efficiently, reduce the risk of groundwater pollution, and comply with existing regulations. The California Fertilization Guidelines provide research-based information for nitrogen, phosphorus, and potassium management for a large number of crops. The sites are user-friendly and easy to navigate. These sites are important resources for growers and crop advisers when making nutrient management decisions.

Animals and Their Systems

Maintaining safe, healthy and productive animal agriculture production practices while conserving natural resources is a key goal in the development of animal welfare and production management systems. Highlighted examples of UC ANR advances include:

• Commercial freshwater and marine aquaculture in California is a diverse industry producing dozens of species of finfish and shellfish; all with different methodologies and system designs for their culture. Program outreach in production technology and animal welfare has delivered information that has increased the skills of aquaculture company personnel in aquatic animal production technology, facility site selection, production system design, system management, species biology, disease, toxicology, animal welfare, permits and regulations in California and other states nationally. The technology and information has improved the efficiency of these companies, which has led to increased profits. Work in shellfish sanitation has assisted state agencies in California and nationally to reassess how they monitor and assess sanitation conditions in shellfish growing areas to better regulate and safeguard public health.

• The goal of one applied animal behavior and welfare project was to improve understanding of on-farm animal welfare assessment for laying hens and use welfare assessment tools to evaluate different hen housing systems. Data was collected on hen health, physical condition, and behavior from commercial egg farms in California and Iowa, two of the largest egg producing states. These farms housed hens in conventional cages, enriched cages, and cage-free systems, including free range and organic systems. The performance-based European Union Welfare Quality Assessment (WQA) tool for the physical evaluation was used for the assessments and validated by relating it to causes of flock mortality as determined by necropsy. The data revealed new information about hen housing system differences in the incidence and severity of different welfare problems such as feather loss, foot health problems, keel bone deformities, poor beak condition, behavioral abnormalities, and disease. It also showed that both the incidence and severity of many of these problems change during the course of the laying cycle. This latter finding is important because it demonstrates that audit results can be strongly influenced by the age of the hens at the time of the assessment, indicating that different benchmarks might need to be set for different stages of the lay cycle. These results are now being used by a variety of food system stakeholders to make egg supply, purchasing, and auditing decisions related to hen housing systems.

Technological Innovation

Technology and innovation will be essential in addressing the challenges and demands of climate change, water constraints, regulations, pest management, and other factors facing production agriculture. Precision agriculture and decision aid tools should result in more efficient resource management, increased returns, and sustainability. A highlighted example of UC ANR advances follows:

• Researchers continue to simplify on-farm decision-making through the use of innovative technology. The creation and integration of two tools has significantly helped farmers conserve water and make better use of nitrogen fertilizer while maintaining crop productivity and quality. The soil nitrate quick test is an in-field test that lets growers quickly determine whether their soil has adequate nitrogen. Weather-based irrigation scheduling uses weather station data to determine actual crop water needs. Both tools use information about the specific crops and sites to determine how much fertilizer and water each will need from the soil. CropManage (https://cropmanage.ucanr.edu/) is an online application that makes both tools easy and accessible for growers to use in the field. Commercial-scale trials in lettuce demonstrated that growers using CropManage can reduce nitrogen and water without compromising quality or yield. The nitrogen rate recommended by CropManage generated yields similar to those of the growers' standard practice, but with a significant reduction in nitrogen fertilizer applied. Commercial-scale CropManage trials with broccoli used 48% less water than is used for conventional plantings, with no reductions in yield or crop quality. Commercial usage of CropManage continues to grow as additional crops are added.

Endemic and Invasive Pests and Diseases

Pests threaten the productivity, biodiversity, and health of California's natural areas and agricultural production, urban (including structures), and animal systems. These pests include arthropods, nematodes, mollusks, and other invertebrates, weeds, plant and animal diseases, birds, rodents and other mammals, and other taxa. Many of the damaging pests are non-native to California and these exotic pests enter the state in spite of state and federal regulatory programs and inspections at state and international borders and other ports of entry. New pathways for introduction are frequently identified such as the aquarium trade for aquatic pests and via movement of beehives or produce shipping containers for certain hitchhiking pests. Natural dispersal and adaptation of pests also leads to new pest management challenges in California and this is often driven by changes in global climate patterns, crop selection, and crop or livestock management practices.

UC ANR's Endemic and Invasive Pests and Diseases Strategic Initiative and Federal Planned Program meets these significant pest challenges, addressing detection, biology, and management of pests and diseases that can impact human, livestock or plant health, stored products, postharvest products, buildings, or those that affect natural systems such as wildlands and waterways. The goals are to foster research and extension programs that 1) exclude pests, pathogens and diseases using diagnostics, detection, interception, response, and mitigation, 2) develop information that responds to emerging and re-emerging problems with pests and diseases, and 3) provide long-term integrated pest management (IPM) solutions for established pests that are economically and environmentally sustainable and socially appropriate.

During FY 2017, 131 Hatch projects were conducted by investigators at UC Riverside, Davis, and Berkeley. CE specialists worked on 45 research and extension projects. CE advisors worked on 287 extension projects, and led an additional 79 research projects under the Federal Planned Program, Endemic and Invasive Pests and Disease. A significant amount of research and extension activity addresses pest management issues on specialty crops including vegetables, tree and vine fruit crops, and tree nut crops. The following examples illustrate the breadth of work and include selected highlights of accomplishments in this program area.

Detection and Diagnostics

Early detection of pests, especially new invasive species, and proper diagnosis/identification are critical steps for optimizing the chances of limiting establishment. Lack of early detection may result in expensive pest and disease management costs in the long-term, disruption in commerce and industry prosperity, and

human and animal health impacts if diseases are involved. Having an early detection system in place may make eradication of pests and diseases feasible. Highlighted examples of UC ANR advances include:

- Molecular diagnostic methods were developed, streamlined, or validated for numerous plant pathogens including the Rhodococcus spp. bacteria which may cause pistachio bushy top syndrome (Leveau), Candidatus Liberibacter spp. (HLB/citrus greening), and Spiroplasma citri (citrus stubborn disease).
- The application of the high throughput diagnostic protocols resulted in the identification and confirmation of the first natural occurrence of a new citrus pathogen (citrus viroid V) in California.
- High throughput sequencing (HTS) analysis for detection of grapevine viruses was found to be superior to the standard grafting bioassay, even at low titers.
- The development and optimization of a molecular diagnostic for spotted wing drosophila (Drosophila suzukii) (SWD) was completed and a guide for performing this test was produced. The first significant genomic assembly of Tuta absoluta, a serious pest of tomato, was also completed. This will provide the foundation for the design of a species diagnostic to differentiate this species with closely related species.
- Genetic comparisons confirmed multiple introductions of the mosquito Aedes aegypti from different geographical regions into California. Genetic comparisons have also been used to determine the phylogeography of the cryptic species of the Euwallacea fornicates species complex. Two of these species have invaded California: Kuroshio Shot Hole Borer and the Polypahagous Shot Hole Borer. This knowledge has been used for a targeted search of natural enemies in Taiwan where several species of natural enemies were found. Research on these beetles in urban and native forests modeled potential geographic range limits, and determined the host preference/suitability.
- A new pest to ornamental and commercial date palms, the South American palm weevil, was detected in San Diego County. To delineate the spread of this insect, a monitoring program has begun and studies in quarantine were initiated to assess the dispersal capacity of the weevils.
- The pheromone for rednecked peach borer (Aromia bungii), a pest of stone fruits which was deemed as very high risk for the U.S., was identified and successfully field tested. Pheromones of other highly invasive and damaging woodboring insects were also identified, providing sensitive methods of detecting them as soon as possible after they are introduced.
- Long-term surveys showed that the nursery quarantine treatment program for glassywinged sharpshooter (vector of Xylella fastidiosa (Xf)) has been 100% effective in preventing the spread of this insect and that larval populations of light brown apple moth (Epiphyas postvittana) had minimal geographical expansion since its discovery in 2006.
- A high throughput bioassay method for assaying attractants for invasive snail and slug species was developed and is the first step towards developing attractant lures for detection, monitoring, and control of invasive pest slug and snail species.

Emerging and Re-emerging Pests and Diseases

Emerging problems can arise from endemic or newly established invasive species and these must be addressed to minimize their impacts on agriculture, natural resources, and urban systems. In contrast, re-emerging pests and diseases are those that were once major problems and then declined dramatically but are again becoming significant problems whose impact is increasing due to human activities or climatic and ecological changes. Highlighted examples of UC ANR advances include:

- Discovery that alterations to the outermost portion of the lipopolysaccharide (LPS), the O-antigen, drastically increased the adhesive properties of Xf within the plant, but the alteration had the opposite effect in the insect vector where the bacteria were only loosely attached to the insect foregut cuticle.
- Development of an environmentally friendly, economical, and species-specific biopesticide that targets SWD using transgenic yeast to deliver double-stranded RNA that knock down genes critical for SWD survival. A provisional patent was submitted for this technology.
- Release of more than 2.75 million parasitoids (Tamarixia radiata) for Asian citrus psyllid at about

1,500 different sites, with about 98% establishment at monitored sites.

• A biological control project was initiated with the aim of rearing and releasing two parasitoid species for the pink hibiscus mealybug which invaded the Coachella Valley and has expanded into a major pest problem in the urban centers of the Valley.

• In the first survey in North America of ectoparasites of backyard chickens, backyard chickens were found to have a far higher diversity of ectoparasites than commercial caged hens. If commercial operations move from cage systems to free range, there may also be an increase in ectoparasite diversity in those systems.

• Field guides to identify sign and symptoms and a decision support tool for invasive polyphagous shot hole borer and associated Fusarium dieback were produced.

• Several types of extension and management programs were implemented resulting in improved pest suppression and delaying the impact HLB disease has on the citrus industry. .

• Examination of barriers to IPM adoption of two invasive species (medusahead in rangelands and HLB in urban areas will be used develop methods to overcome these adoption barriers.

• Potential biocontrol fungal and bacterial grapevine endophytic strains for management of Pierce's Disease were identified.

• A new disease of olive, Neofabraea leaf and fruit spot, branch canker and twig lesion was identified. A key finding was that the disease was shown to be highly correlated with mechanical harvest, where wounds produced by harvesters serve as the main infection sites for the pathogens.

• Work on the impact and movement of weed rice on cultivated rice resulted in the adoption of regulations that require all rice fields (550,000 acres annually) to be planted with certified seed.

• Sticky panel traps were determined to be cheaper and more efficient than standard pyramid trap for monitoring the new pest, brown marmorated stink bug, in peaches and almonds.

Integrated Management of Established Pests and Diseases

Integrated management approaches are used to reduce the impact established of pests and diseases on agriculture, natural resources, and urban systems through the development of science-based pest management programs that are economically and environmentally sustainable and socially appropriate. These integrated pest management (IPM) programs for existing, established pests require frequent refinement to stay relevant. Changes in efficacy of current management tactics, adjustments in production strategies, revisions in crop landscapes, unusual environmental conditions, and other controllable and uncontrollable situations modify the impacts of pests. Highlighted examples of UC ANR advances include:

• Breeding for pathogen resistance advanced for Fusarium wilt in strawberry, Pseudomonas syringae pv. tomato in tomato, lettuce drop in lettuce, and Pierces disease in grapevines. Carrot lines resistant to root knot nematode isolates were identified.

• Biocontrol: Two bacteria and one fungus were identified as potential biocontrols for management of Pierces disease of grapevines (PD). For nematodes, a new strain of the nematophagous fungus Pochonia chlamydosporia was identified and was shown to significantly reduce egg hatch of a root knot nematode species. Also for nematode biocontrol, studies showed that there was a predicable relationship between the initial levels of the nematophagous fungus Dactylella oviparasitica and final populations of the sugarbeet cyst nematode and that this outcome will likely be applicable to other crops. In a cost benefit analysis, Paine found that for every dollar invested in biological control of eucalyptus pests and street trees, the cost:benefit ratio ranged between $1:428 to $1:1,070.

• A natural-based product that has activity against XF is in the greenhouse testing phase.

• Providing dust boxes with diatomaceous earth or hanging sulfur dust bags in cages can prevent economically damaging infestations of mites, including those resistant to permethrin, in poultry houses.

• A novel solution to the weed discrimination problem in robotic weeding systems was developed and validated.

• Monitoring the first flight of citrus peelminer moths (Marmara gulosa) and California red scale (Aonidiella aurantii) combined with degree-days provided treatment timings for citrus growers and

improved efficacy of pesticides.

• Research determined that the efficacy of pesticide sprays for spider egg sac control is highly dependent upon the formulation of the pesticide sprays due to the egg sacs silk's strong hydrophobicity.

• Identification of a previously unidentified Alternaria species causing fruit rot of pomegranates in California resulted in international trade restrictions being lifted.

• The first documented case of a plant pathogen (tomato spotted wilt tospovirus) having a direct effect on its insect vector (thrips), as opposed to an indirect effect mediated through the plant, was reported.

• Researchers found that a single treatment of an ethylene inhibitor to potatoes prevented insect attraction to and reproduction on Potato Virus Y (PVY)-stressed plants and completely prevented PVY spread for at least three weeks.

• A "Fly Liquid Ingestion Counter" assay system was used to determine which chemical, molecular or cellular features are the most important predictors of anti-feedant activity in fruit flies.

• The first organ-specific transcriptome for any Thysanopteran sp. (thrips) was produced. This work will be a critical foundation as genes to be targeted in next generation resistance strategies are identified.

• CE Advisors were active in a national series of workshops for IPM for important pests in structures such as bed bugs, ants, and cockroaches, providing training for housing managers, maintenance supervisors, and social workers.

• A new easy to use monitoring method for springtails in lettuce was developed using beet slices.

• Management of sudden oak death in California was improved by identifying minimum distances for removal of bay laurel to protect oaks and modifying treatment recommendations.

• Plant-parasitic nematodes addressed monitoring and management. Species were successfully monitored over several years, contributing new fundamental knowledge and improving both recommendations for sampling and the ability to interpret samples obtained at different times of the year. Field trials of environmentally safer non-fumigant nematicides showed that they are effective in increasing marketable yields of some crops as much as 90% over that in untreated fields.

• Research determined that hedgerows can attract beneficial insects including natural enemies for enhanced pest control in adjacent crops without a threat of food safety issues from wildlife.

• CE Advisor Entomologists used more than 1,500 acres of research and demonstration plots to show that mating disruption is a viable alternative to traditional pesticides for navel orangeworm in the more than 1.8 million acres of California nut crops.

• Through the use of GPS guided technologies, a public-private partnership developed a spot fumigation method that reduced soil fumigant usage by 50% while maintaining almond tree yields and mitigating the impacts of root pathogens and nematodes in comparison to the standard commercial procedure.

• A significant advance in detection of canker-causing fungal pathogens in very young plant tissues was made allowing for management of these diseases before the appearance of any symptoms .

Sustainable Natural Ecosystems

"Sustainable" refers to the ability to continue a practice indefinitely, supported by three pillars: economic, social, and environmental. "Natural Ecosystems" is the umbrella term for rangelands, forests, and wetlands. These lands typically, in California, are upstream or downstream from intensively managed agricultural and residential lands. Natural ecosystems are valuable to society for the goods and services they provide. Yet their sustainability is complex due to ecological diversity and mixed ownership.

UC ANR's Sustainable Natural Ecosystem Strategic Initiative and Federal Planned Program aims to identify and prioritize issues and solutions affecting California's natural ecosystems. Some of those issues include understanding and valuing ecosystem services, maintaining working landscapes, biodiversity, climate change, regulations, and land use change and fragmentation.

During FY 2017, 123 Hatch and Multistate research projects were conducted by investigators at UC Berkeley, Davis, and Riverside. CE specialists worked on 33 research and extension projects. CE advisors

worked on 115 extension projects, and led an additional 17 research projects under the Federal Planned Program Sustainable Natural Ecosystems. Projects are being conducted in several areas that are essential to sustaining California's natural resources. A few examples of the breadth of projects along with selected examples of high impact programs follow.

Ecosystem Services & Working Landscapes

Ecosystems and working landscapes provide benefits or services vital to agriculture and the environment including natural diversity of plant and animal life, recreational space, and natural resource accessibility. A highlighted example of UC ANR advances follows:

• A five-year and continuing study is focused on determining how range plant species, their density and range management practices, influence multiple ecosystem services, including plant production, erosion control, soil fertility, water quality, water storage, invasion control, and soil carbon storage. Specific research looked at the effects on California grassland communities (including invasive weeds) and multiple ecosystem services by manipulating precipitation, timing of grazing and nitrogen determination. Also studied is how seed production and seedling thinning drive nutrient supply and plant production. In relatively wetter areas (coastal hills, riparian), the drought continues to enhance perennial grasses. However, in the drier areas (Central Valley and the lower foothills) previously robust stands of perennial grasses are failing to produce viable seed, and in many cases are dying. Also it appears that the forb seedbank is critical for resilient vegetation cover and production during drought, and that the recovery of grass production may be delayed once the drought is over; it may take a few growing seasons to reestablish grass seed density. These discoveries provide valuable considerations for rangeland owners and managers for responding to climate change.

Range Resources Management

Rangeland and grassland ecosystems provide benefits vital to agriculture and the environment including grazing and forage for livestock and native animals, watersheds for rural and urban uses, habitat for plants, insects, and animals, water for sustainable landscapes, areas for recreational activities, and renewable energy and mineral resources. Highlighted examples of UC ANR advances include:

• A study compiled a statewide resurvey of ~120 vegetation plots in grassland and shrubland areas to assess plant community changes from before the 2012-2014 drought to after the drought. Another long term similar grassland data set from a reserve in the Coast Range was also analyzed. The researchers found that plant community responses to drought were predicted well with the long-term data set, but not the statewide survey. Results showed that repeated years of extreme drought produced a greater than expected drop in this grassland productivity.
• Researchers studied the interaction of climate change and local-scale patterning on an invasive rangeland grass barb goatgrass (Aegliops triuncialis), by manipulating rainfall, seed density, and local-scale seeding pattern on the northern California Coast Range. Seeding pattern was either evenly distributed or aggregated. Demographic and environmental data were collected for three years following initial establishment. Results showed that pattern and scale figure prominently in the demographic response of barb goatgrass to climate change. Aggregated planting led to a multi-year increase in per-plant seed output, especially in the final and driest of the three study years. Pattern also interacts with rainfall and seeding density in its influence on per-plant seed output.

Wildlife & Fisheries

Wildlife and fisheries preservation and habitat enhancements are another component of California's natural ecosystems and the working landscapes. Conflicts with wildlife occur in both the rural and urban settings. Highlighted examples of UC ANR advances include:

• Desert tortoises have low survival as juveniles, are long lived and slow growing and can take 15-20 years to reach sexual maturity and begin reproducing. Methods that increase survival and growth rates of juveniles may enhance opportunities to recover declining populations and mitigate potential declines of tortoises from development. One project aimed to determine and compare survival rates desert tortoises in the Mojave National Preserve: direct-release; rain-supplemented head-start; and non-supplemented head-start juvenile. Head-starting juvenile desert tortoises in semi-natural outdoor enclosures with added water from sprinklers and protection from predators greatly increased their growth and survival, relative to free-ranging tortoises that were released and monitored in the field.

• In managed rangelands and agricultural areas, wild pigs (Sus scrofa) are a significant pest species. Capturing the geographical extent of wild pig damage would allow land managers to more effectively mitigate wild pig damage by allowing identification of specific areas that are conducive to wild pigs, and could also allow for a clearer delineation of economic losses. Researches created a mobile app to assist land managers by assessing the type, nature, and extent of damage occurring on their property. Long-term data collection from the mobile app could influence policy decision makers given the new ability to report impacts on a county, regional, state, or national level.

• A collaborative study, including UC, the US Forest Service, and Pacific Southwest Research Station scientists, is examining the habitat value to insectivorous bats of the remnant valley oak tree within the vineyard. Fourteen cooperating grape growers in San Luis Obispo County are helping scientists answer this question. Bat echolocation-call recorders were set-up, one at the tree and one 100 meters from the tree within the open vineyard. At the tree and the no-tree sites, insect trap were also erected to assess insect abundance. This research found that valley oak trees bring insect-eating bats into vineyards; this has the potential to help growers manage pests and thus reduce the use of chemical pesticides.

Forestry

Trees are one of California's most valuable renewable resources. Not only do they provide products used in construction, but they are essential in habitat for wildlife, recreation, and carbon sequestration. Sustainable ecosystems must include forests, and they must be understood to preserve and protect them. Highlighted examples of UC ANR advances include:

• The goal of this study was to develop equipment and mechanisms for reducing potential wildfire in forest stands. Two alternatives for residual biomass fuel hazard reduction were conducted at Blodget Forest Research Station, California. The default option was open pile burning. The second option - use biomass for electricity production - was shown to produce energy and emission benefits. Energy (diesel fuel) expended for processing and transport was equivalent to only 2.5% of the energy content of the biomass fuel. Based on measurements from a large pile burn, air emissions reduction was 98%-99% for PM2.5, CO non-methane organic compounds, CH4 and black carbon, and 20% for NOx and CO2-equivalent greenhouse gasses.

• Another study evaluated the effects of wildfire on the molecular transformation of nitrogen by high and low intensity wildfires in the presence and absence of oxygen. Forest fires are increasing in both frequency and intensity in California and the western United States potentially altering the chemistry and quantity of dissolved nitrogen, dissolved organic matter and disinfection byproduct precursors. These may affect water quality. Unburned and burned detritus in the presence of and absence of oxygen were analyzed. Results indicated that potential pollutants are highly dependent on temperature and oxygen availability.

• Another project studied the effects of a mixed conifer forest of fuels on snowpack dynamics. The study found that large open patches, associated with severe fire in untreated forest, accumulated more snow initially than areas of denser tree canopy, but also that the snowpack duration was particularly low in the large open patches. In terms of snowpack duration, the persistence of soil moisture levels into late spring and summer, areas of forest that had received fuels treatments before being exposed to wildfire had longer snowpack duration. This was because they included small gaps where snow accumulated more heavily than under closed canopy, but also where snowmelt was slowed by surrounding trees. This project

helps to understand and manage responses of California forests and rangeland to drought and fire.

Water Quantity, Quality and Security

Water supply and quality for agricultural, urban, and environmental systems are one of the state's biggest challenges.

UC ANR's Water Quantity, Quality and Security Strategic Initiative and Federal Planned Program works to directly impact California watersheds and California's water security. Projects are being performed in a number of areas that will directly impact California watersheds and California's water security.

During FY2017, 31 Hatch and Multistate research projects were conducted by investigators at UC Berkeley, Davis, and Riverside. CE specialists worked on 13 research and extension projects. CE advisors worked on 73 extension projects, and led an additional 7 research projects under the Federal Planned Program Water Quantity, Quality and Security. The following illustrates the breadth of work and includes selected examples highlighting accomplishments in this program area.

Groundwater Recharge

Management of groundwater recharge is important for both quantity and quality purposes. The drought has increased attention on sustainable groundwater management throughout the state. A highlighted example of UC ANR advancing this area:

• Work is being performed to assess the potential to use storm/flood water on agricultural lands to increase groundwater recharge. We are studying the potential for this on almonds, irrigated pasture, low nutrient input row crops and alfalfa and will look to extend it to other crops depending upon results. This would increase the amount of freshwater recharge and lessen overdraft in groundwater aquifers. This work will be increasingly important as precipitation variability will increase with climate variability.

Groundwater Quality

Increases in irrigation efficiency can lead to increased concentrations of salts being leached to groundwater aquifers. In addition, nitrate pollution to groundwater sources is a major concern in California. Highlighted examples of UC ANR advances include:

• One project looks at irrigation sustainability at the centuries to millennia time scale to assess the potential for long-term salinity buildup in groundwater. Results show gradual degradation of groundwater quality throughout the state.
• Additional work is underway to look at the potential for recycled waste water to increase this degradation through increased salt accumulation. Mitigation for salt accumulation includes rainfall and irrigation with fresh water. Agricultural production with recycled, reused, or otherwise lower quality waters is of increasing importance in regions that face chronic water shortages.
• Irrigation managers, consultants, and growers are learning the importance of well water quality assessment, being able to interpret water quality reports, test their soils and crops for salinity and boron related problems, and leach soils during the winter months when evapotranspiration is low.

• Collaboration with the California State Water Board to assess modeling tools that can be used for evaluation of the assimilative capacity in groundwater basins with respect to salts and nitrate.
• Collaboration with the California Almond Board and a grower-cooperator to establish a long-term nutrient, soil, and groundwater monitoring site to evaluate nitrogen fluxes in an almond orchard and their response to improved irrigation and nutrient management. Almonds are now one of the dominant crops in

California and have high nitrogen input requirements.

• Research to reduce nitrate pollution has focused on the main pathway, leaching. By increasing irrigation efficiency and optimizing nitrogen applications we can reduce leaching.

• Additional research on the use of bioreactors to clean up nitrogen laden groundwater and surface water flows is showing promising techniques to increase their efficiency. New research and curriculum development is increasing capacity within the state to solve this problem.

Water Use Efficiency

Increasing water use efficiency is critical to creating value from out water supplies. Highlighted examples of UC ANR advances include:

• Combinations of biochar and compost were used to improve water flow in a well-studied heavy clay soil and to ameliorate potential salt and other toxicity. Wheat yield increased greatly with high application rates of biochar.

• Work was performed on micro irrigation technologies to maximize potential water savings and crop yields. Management of the technologies is critical to reach these goals. Work on canopy cover sensing is being performed to help us determine orchard water use and water needs. This work involves in-field data collection as well as aerial and space remote sensing. The research to date has led to increased yields and thus increases in water use efficiency.

• Research was performed to generate empirical data on the water requirements for winegrape production in the San Joaquin Valley in order to protect and sustain the supply of fresh water needed for viticulture in that region. In particular, this work will help determine the blue water footprint of grapevines as a function of three irrigation treatments.

• Work is proceeding on the use of plant genetics for breeding drought tolerant varieties of several field crops. This involves identification of pathways and methodologies for testing drought tolerance.

• Work is proceeding to reduce water use and manage salinity in turf grasses. Through breeding, genetics, weed control, and irrigation management we are working to lessen the impacts of turfgrass in the state. Management and irrigation scheduling can have significant impacts on water use by turfgrass.

• We have recently obtained results from our work assessing the potential impacts of reuse of winery wastewater on vineyards and wine production and quality. Results show that properly managed use of winery waste water does not impact production or quality. The use of this water can reduce vineyard water demand and lessen offsite impacts from winery waste.

Water Policy

The importance of water to California and its economy is evidenced by the intensity of its policy debates. UC continues to inform these debates with sound science and with scientific policy analysis. Highlighted examples of UC ANR advances include:

• Research and outreach evaluated regulatory instruments and policy options to manage nitrate pollution in our groundwater systems. Further efforts were made to outline potential funding mechanisms to fund the provision of safe drinking water in the affected communities of the Tulare Lake and Salinas Basins.

• Additional work was done on the impacts of a change in water supply on the agricultural economy of the San Joaquin Valley.

Sustainable Energy

California continues to pursue renewable sources of energy and research is needed to understand the potential for both high value renewable products and fuels created from agricultural and natural feedstocks and/or waste products. In 2016, biomass power plants in California produced 3.14 percent of the total

electrical needs for the state. Six ethanol plants reside in California which has the potential to produce 223 million gallons of ethanol a year. These plants rely on corn, sorghum, cheese whey, and beverage waste as their renewable feedstock. California reported four biodiesel plants producing a potential capacity of 20.5 million gallons annually.

UC ANR's role in improving energy security and green technologies include research and support of new production technologies that minimize fossil fuel energy consumption, develop new technologies and marketing strategies, and use of genetic, genomic engineering, and agronomic research to produce sustainable feedstocks from forest, agriculture production, and waste. This research will develop science-based policies and information to guide policy makers on issues related to energy.

During FY 2017, 21 Hatch and Multistate Research projects with a sustainable energy focus were conducted by investigators at UC Davis, Berkeley, and Riverside. A CE specialist and a CE Advisors also worked on projects focused on the Federal Planned Program Sustainable Energy. Projects are being conducted on conversion, policy, and agronomics that are essential to sustaining California's energy needs. The following illustrates the breadth of work and includes selected examples of high impact projects and programs.

Biofuel Crops

Biofuel feedstocks must be produced in a sustainable way in order to not compete with food crops on prime agricultural lands. The UC system has an aggressive policy to be carbon neutral by 2025 and research and deployment of renewables will continue to be a major research focus for UC scientists. UC research is currently underway to evaluate the potential for various feedstocks that could play a role in California's agricultural diverse cropping systems and include crops such as sorghum, oilseeds, sugarbeets, and other potential crops. Highlighted examples of UC ANR advances include:

- Research is being conducted on sorghum, an annual crop that could be both a short-term and long-term solution for California's need for a renewable, sustainable biomass feedstock. Replicated field trials continue to evaluate both grain and biomass production throughout the state and there is an ongoing program to evaluate these sorghums for their water use efficiency. This will provide valuable information on the potential of sorghum as a viable feedstock for renewable fuel production in the state. The Department of Energy (DOE) ARPA-E program is funding two multi-disciplinary sorghum research programs and based on outcomes, genes and molecular markers will be identified to devise genetic strategies for improving drought tolerance in sorghum and other bioenergy crops.
- Another project in being conducted to express genes in rice that will reduce the cost of generating fermentable sugars from rice plant cell walls.
- Another project is looking at how photosynthetic microorganisms, such as cyanobacteria or unicellular microalgae, can grow to high densities within fully enclosed photo-bioreactors. Research is underway to optimize these photosynthesis-to-fuels systems for the generation of terpene hydrocarbons. Such a system would enable oxygenic photosynthesis to convert solar energy and store it in the form of hydrocarbons.
- Several research projects are using breeding and agronomic evaluation to improve crops and cropping systems to increase nitrogen use efficiency in plants and improve irrigation strategies. The goal is to increase yields through both a better understanding of water use efficiency in plants and through plant breeding that improves plants to be converted to renewable products.

Conversion to Biofuels

Novel ways to either increase the efficiency of renewable fuel production by efficient breakdown of cell walls or by generating new renewable products from biomass feedstock are needed. Highlighted examples of UC ANR advances include:

• Research is underway to breakdown plant cell walls and generate plants representing novel biomaterials and feedstocks for biorefineries. One project is working to alter biosysthesis and composition of cell walls to increase their yields that can then be converted in unique renewable products.
• Research is underway to evaluate strategies to create natural fibers and biobased polymers and to improve the efficiency of converting starch into oils for renewable products.
• Other projects are developing strategies to deploy feedstock supply knowledge, processes, and logistic systems that will provide timely and sufficient quantities of biomass to feedstock plants.

Policy and Economics

Policy and economics of renewable electricity and fuels remain important in California. Highlighted examples of UC ANR advances include:

• One project continues to quantify how short-run volatility in renewable electricity (i.e. intermittency) affects the amount of air pollution emitted by interconnected fossil fuel generating units in the California electricity market. Additional work has analyzed the low carbon fuels standards and renewable fuel standards and their impact on production of renewable fuels in California.

Total Actual Amount of professional FTEs/SYs for this State

Year: 2017	Extension		Research	
	1862	1890	1862	1890
Plan	321.0	0.0	358.0	0.0
Actual	259.2	0.0	400.1	0.0

II. Merit Review Process

1. The Merit Review Process that was Employed for this year

- Internal University Panel
- Combined External and Internal University Panel
- Combined External and Internal University External Non-University Panel
- Expert Peer Review

2. Brief Explanation

Scientific Peer Review
Each project funded under the Hatch Act is peer reviewed at the department level in the colleges/school at Berkeley, Davis, and Riverside. A peer review committee is appointed by the department chair. The committee evaluates the relevance, quality, and scientific value of the proposed research. Upon completion of the peer review, the project is also reviewed at the dean's office for USDA compliance and forwarded to the Vice President's office for final review and submission to NIFA.

Merit Review
UC ANR's organizational structure emphasizes that resource allocation decisions will be driven by programmatic considerations and developed through a broad participatory process. This process includes review of the quality and relevance to program goals for all of the Division's programs.

At the statewide level, the UC ANR Program Council met almost monthly. It was chaired by the Associate Vice President, and included the four Executive Associate Deans, five strategic initiative leaders, and two CE representatives, as well as other ex-officio administrative members. This group coordinates Divisionwide planning and delivery of programs, and develops recommendations for allocation of Division resources. The Program Council reviewed all programmatic budget requests from a statewide perspective to make specific recommendations on budget expenditures and resource allocation principles. These recommendations were then considered by the Vice President for final allocation decisions.

UC ANR's strategic initiative leaders and advisory panels are key players in helping the Division meet its goals, by organizing division-wide conferences, developing five-year, statewide strategic plans, and coordinating the internal Competitive Grants Program and the new High-risk/High-reward Grants Program. During FY 2017, the five Strategic Initiatives held 32 panel meetings. UC ANR's Program Teams provide an umbrella structure for the Division's many Workgroups to meet. These Program Teams carry out their essential leadership functions and enhance inter-Workgroup communication and collaboration. During FY 2017, there were 18 Program Teams meetings and 14 Workgroups meeting in conjunction. In addition, the Water Quality, Quantity, and Security Strategic Initiative held a conference.
In January 2017, UC ANR released its fifth internal, competitive grants cycle. During fall of 2017, 50 full proposals (44 for the competitive grants program and 6 for the High-risk/High-reward grants program) were reviewed by technical peer-review panels recruited by the strategic initiative leaders. The technical reviewers depended on the proposals received and included external experts. After each proposal received a technical review by academics that had no conflict of interest with the proposal, the strategic initiative leaders recommended to Program Council a consensus slate of highly ranked proposals based the other program criteria. In FY 2018 the proposals was discussed in detail by Program Council to make final recommendations for funding, and final decisions were made by UC ANR's Vice President.
UC ANR actively engages stakeholders in a thorough process to determine the highest priority Cooperative Extension academic positions to rebuild and strengthen the UC ANR network, given the many retirements over the past few years and to address programmatic gaps and emerging needs. The process expects consultation and discussions with internal UC ANR stakeholders in all program areas, and strongly encourages engaging external stakeholders, including commodity groups, cooperating programs, agency partners, community groups, and others, to explicitly discuss the priority needs for these positions. The proposals, along with information regarding current staffing and retirement projections, is considered by UC ANR Program Council in their deliberations to provide recommendations the Vice President, who then makes the final decision. The call for CE positions is released every other year; no call was released in FY 2017. The next call is released January 2018.

III. Stakeholder Input

1. Actions taken to seek stakeholder input that encouraged their participation

- Use of media to announce public meetings and listening sessions
- Targeted invitation to traditional stakeholder groups
- Targeted invitation to non-traditional stakeholder groups
- Targeted invitation to traditional stakeholder individuals
- Targeted invitation to non-traditional stakeholder individuals
- Targeted invitation to selected individuals from general public
- Survey of traditional stakeholder groups
- Survey of traditional stakeholder individuals
- Survey specifically with non-traditional groups
- Survey specifically with non-traditional individuals

- Survey of selected individuals from the general public

Brief explanation.

UC ANR used a variety of mechanisms to seek stakeholder input on the development of Division program priorities and use of its research, extension and education funds. In addition, CE advisors delivering programs in 58 California counties received input on local needs from their local clientele on a daily basis. All of the input received from stakeholders was used by UC ANR members in program planning and implementation at the local, regional, and statewide level.

UC ANR Strategic Planning
UC ANR continued to make significant progress toward its Strategic Vision 2025, completing the development of and implementing the 2016-2020 Strategic Plan. The stakeholder input received throughout the process helped clarify and refine the core values, strategic objectives, and goals. During FY 2017, UC ANR hosted a retreat to get diverse stakeholder feedback to "move the strategic plan from paper to process." In addition, for Goal 5: prioritize programs and services, there were two internal stakeholder meetings to collaboratively draft public value statements and identify condition changes. The process included input from the Strategic Initiative Leaders, Statewide Programs and Institutes, and Program Teams, which represent the Division's diverse program areas and wide variety of disciplines.

Research and Extension Center System Strategic Planning
UC ANR's Research and Extension Center system, consisting of nine centers statewide, continued strategic planning focused on stakeholder guidance. During FY 2017, the final two centers completed their strategic plans. Stakeholder input was sought both through the diverse committees, including CE advisors, CE specialists, and AES faculty and members from external stakeholder groups, as well through broad feedback loops conducted throughout the process, reaching additional stakeholder groups identified by the committee. The strategic planning process was collaborative, future-oriented and utilization-focused, and included assessment, strategy formation, and implementation accountability. Situational and stakeholder analysis identifies key strengths and opportunities, as well as challenges to inform the development of the strategic directions, each with specific goals, intended outcomes, and key actions that include identified implementation responsibility and anticipated deliverables.

Statewide Program and Institutes Strategic Planning & Reviews
Each of the Division's eight statewide programs and two statewide institutes undergoes a routine program planning and review efforts that designed to solicit and incorporate significant input from key stakeholder groups. The strategic planning processes are highly collaborative, including a committee with representatives of diverse stakeholder interests. Those members then also outreach to additional stakeholder groups for their input. Similarly, the review committees include members from across the UC ANR network and external stakeholder representatives. As part of the review process, the committee also solicits input from additional stakeholders through interviews and web-based surveys. During FY 2017, the California Institute for Water Resources and the California 4-H Youth Development Program launched strategic planning and the Informatics and GIS Statewide Program underwent a review.

Strategic Initiative, Program Team, and Workgroup Meetings
The Strategic Initiative, Program Team, and Workgroup Meetings are the primary mechanism for accomplishing UC ANR's high priority research and extension goals through grassroots leadership. During FY 2017, the five Strategic Initiatives held 32 panel meetings, and there were18 Program Team meetings with 14 Workgroups meeting in conjunction. These meetings brought

together AES and CE personnel and non-ANR partners to work on emerging and continuing priority issues in Division program areas. Workgroups involve external stakeholders in their program planning process and Workgroup activities and projects. The involvement of external stakeholders in the Workgroups ensures that real world needs are brought to the attention of the Division as programs are planned and implemented. External stakeholders on the workgroups include individual producers, representatives from local community groups, state and federal agencies, industry groups, consumer groups, and colleagues from other higher education institutions.

Formal advisory groups
The President's Advisory Commission on Agriculture and Natural Resources meets twice annually to advise and assist UC in identifying the educational needs of the state's agricultural, natural and human resources communities and ways to meet them through science-based research, educational outreach and classroom instruction. The members represent close to 30 different business, consumer, youth and government leaders from throughout California and meet twice a year to provide input. The UC ANR Vice President participates as a member of this Commission and brings the Commission's advice to the UC ANR Executive Council, which includes the four Deans from the UC ANR affiliated colleges/school. This leadership council then provides strategic guidance in the articulation of long-term programmatic directions Divisionwide, the allocation of resources across units, and the development of UC ANR policies.
Each of the three colleges at Berkeley, Davis and Riverside and the School of Veterinary Medicine at Davis, have external stakeholder advisory councils that met at least annually to provide feedback on their research, extension, and teaching programs. In addition, departments may have advisory boards. The Statewide Programs also have advisory groups, some mostly composed of external members, which meet regularly to review progress and offer recommendations for future program direction.

Commodity Organizations/Marketing Order Boards
Members of these organizations provided their annual input on research and extension needs for their commodities to UC ANR members through regular meetings and discussion of funding for research projects.

2(A). A brief statement of the process that was used by the recipient institution to identify individuals and groups stakeholders and to collect input from them

1. Method to identify individuals and groups

- Use Advisory Committees
- Use Internal Focus Groups
- Use External Focus Groups
- Open Listening Sessions
- Needs Assessments
- Use Surveys

Brief explanation.

Please see previous Actions to Seek discussion.

2(B). A brief statement of the process that was used by the recipient institution to identify individuals and groups who are stakeholders and to collect input from them

1. Methods for collecting Stakeholder Input

- Meeting with traditional Stakeholder groups
- Survey of traditional Stakeholder groups
- Meeting with traditional Stakeholder individuals
- Survey of traditional Stakeholder individuals
- Meeting with the general public (open meeting advertised to all)
- Meeting specifically with non-traditional groups
- Survey specifically with non-traditional groups
- Meeting specifically with non-traditional individuals
- Survey specifically with non-traditional individuals
- Meeting with invited selected individuals from the general public

Brief explanation.

Please see previous Actions to Seek discussion.

3. A statement of how the input will be considered

- In the Budget Process
- To Identify Emerging Issues
- Redirect Extension Programs
- Redirect Research Programs
- In the Action Plans
- To Set Priorities

Brief explanation.

Please see previous Actions to Seek discussion.

Brief Explanation of what you learned from your Stakeholders

Please see previous Actions to Seek discussion.

IV. Expenditure Summary

1. Total Actual Formula dollars Allocated (prepopulated from C-REEMS)			
Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
{No Data Entered}	{No Data Entered}	{No Data Entered}	{No Data Entered}

2. Totaled Actual dollars from Planned Programs Inputs				
	Extension		Research	
	Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
Actual Formula	8437115	0	5916758	0
Actual Matching	8437115	0	5916758	0
Actual All Other	98299807	0	272748839	0
Total Actual Expended	115174037	0	284582355	0

3. Amount of Above Actual Formula Dollars Expended which comes from Carryover funds from previous				
Carryover	0	0	0	0

V. Planned Program Table of Content

V(A). Planned Program (Summary)

Program # 1

1. Name of the Planned Program

Healthy Families and Communities

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
133	Pollution Prevention and Mitigation	0%		1%	
301	Reproductive Performance of Animals	0%		3%	
305	Animal Physiological Processes	0%		9%	
306	Environmental Stress in Animals	0%		2%	
502	New and Improved Food Products	0%		4%	
604	Marketing and Distribution Practices	0%		3%	
606	International Trade and Development	0%		3%	
608	Community Resource Planning and Development	1%		4%	
610	Domestic Policy Analysis	0%		3%	
701	Nutrient Composition of Food	0%		2%	
702	Requirements and Function of Nutrients and Other Food Components	0%		33%	
703	Nutrition Education and Behavior	24%		10%	
704	Nutrition and Hunger in the Population	0%		3%	
723	Hazards to Human Health and Safety	0%		3%	
724	Healthy Lifestyle	14%		4%	
802	Human Development and Family Well-Being	5%		6%	
803	Sociological and Technological Change Affecting Individuals, Families, and Communities	3%		2%	
805	Community Institutions, Health, and Social Services	5%		1%	
806	Youth Development	43%		3%	
903	Communication, Education, and Information Delivery	5%		1%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2017	Extension		Research	
	1862	1890	1862	1890
Plan	13.0	0.0	4.4	0.0
Actual Paid	16.6	0.0	4.1	0.0
Actual Volunteer	805.0	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
2415205	0	647935	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
2415205	0	647935	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
12790768	0	37941532	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

UC ANR's integrated research and extension activities will conduct research projects, workshops, classes, and demonstrations, as well as one-on-one interventions. In addition, the programs will use PSAs, newsletters, mass media, web sites, and collaborations with other agencies and organizations to create and deliver programs.

2. Brief description of the target audience

- Adults, children, youth and families in general
- Children in general
- Low and moderate income adults, children, youth, and families
- Adults and children at-risk for nutrition-related health problems, including individuals living in poverty, recent immigrants, and African-American, Native American, and Hispanic populations
- Nutrition and healthcare professionals
- Preschool, primary, and secondary school teachers and administrators
- Professional childcare providers
- Public agencies and private organizations concerned with food, nutrition, and health

3. How was eXtension used?

UC ANR academics used eXtension to participate in and contribute to Communities of Practice, to answer "Ask an Expert" questions, and for other networking purposes.

V(E). Planned Program (Outputs)

1. Standard output measures

2017	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	483926	0	254086	0

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year:	2017
Actual:	3

Patents listed

Molecular Flux Rates Through Critical Pathways Measured by Stable Isotope Labeling In Vivo, as Targets and Biomarkers of Drug Action

Biochemical Measurement of Muscle Mass by the Dilution of Labeled Creatine in Urinary Creatine

PROTEOLYSIS-RESISTANT CAPSID OF CHIMERIC HEPATITIS E VIRUS AS AN ORAL DELIVERY VECTOR

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2017	Extension	Research	Total
Actual	79	104	183

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Classes/Short Courses Conducted

Year	Actual
2017	254271

Output #2

Output Measure

- Workshops Conducted

Year	Actual
2017	1299

Output #3

Output Measure

- Demonstrations and Field Days Conducted

Year	Actual
2017	111

Output #4

Output Measure

- Newsletters Produced
  Not reporting on this Output for this Annual Report

Output #5

Output Measure

- Web Sites Created or Updated

Year	Actual
2017	21

Output #6

Output Measure

- Research Projects Conducted

Year	Actual
2017	84

Output #7

Output Measure

- Videos, Slide Sets, and other AV or Digital Media Educational Products Created

Year	Actual
2017	27

Output #8

Output Measure

- Manuals and Other Printed Instructional Materials Produced

Year	Actual
2017	3

Output #9

Output Measure

- Popular Articles

Year	Actual
2017	37

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Low-income individuals and families, participating in nutrition and consumer education programs, gain knowledge of food resource management techniques.
2	Low-moderate income individuals and families, participating in nutrition and consumer education programs, adopt recommended food resource management techniques.
3	Children and youth, participating in-school and afterschool educational programs, increase their level of science, agricultural and environmental literacy.
4	Youth educators and child resource specialists, participating in youth development education programs, gain knowledge of youth development practices.
5	Children and youth, participating in nutrition education programs, gain knowledge of nutrition.
6	Adults, participating in nutrition education programs, adopt recommended dietary practices.
7	Individuals, participating in nutrition education programs, adopt safe food handling and preparation techniques.
8	Youth educators and child resource specialists, participating in youth development education programs, adopt recommended youth development practices.
9	Youth educators and program extenders, participating in the programs, including 4-H and SET, gain knowledge of best practices to extend science, engineering, and technology education and opportunities.
10	Teachers, participating in health and nutrition programs, adopt recommended practices to prevent childhood obesity and foster a school environment that reinforces nutrition education.
11	Community garden managers, non-profit agency personnel, small business owners, and low-income members of the public, participating in Master Gardener and other urban horticulture programs, gain knowledge about sustainable gardening practices.
12	Individuals participating in food safety education, gain knowledge of safe food handling, preparation, and preservation techniques.
13	Percentage of 4-H youth (4th- 12th graders) make positive choices.
14	Percentage of 4-H youth (4th- 12th graders) effectively communicate.
15	Percentage of 4-H youth (4th- 12th graders) build connections.
16	Percentage of 4-H youth (4th- 12th graders) apply content knowledge and skills in health, citizenship and science to contribute to the health, growth, and well-being of self, family, community, nation, and the world.
17	Percentage of 4-H youth (4th- 12th graders) express interest and engage in science.

18	Percentage of 4-H youth (4th- 12th graders) express positive attitudes and aspirations toward science.
19	Percentage of 4-H youth (4th- 12th graders) develop science skills and abilities.
20	Percentage of 4-H youth (8th-12th graders) apply learning, and make a contribution through science.
21	Percentage of 4-H youth (4th- 12th graders) appreciate cultural diversity.
22	Percentage of 4-H youth (4th- 12th graders) engage in community and community issues.
23	Percentage of 4-H youth (4th- 12th graders) have understanding of the democratic process.
24	Percentage of 4-H youth (8th-12th graders) have awareness of community and community issues.
25	Percentage of 4-H youth (4th- 12th graders) choose food consistent with Dietary Guidelines.
26	Percentage of 4-H youth (4th- 12th graders) improve physical activity practices.
27	Percentage of 4-H youth (4th- 12th graders) avoid and prevent negative risk behaviors.
28	Percentage who report having interpersonal skills such as teamwork and decision-making.
29	Percentage who report having intrapersonal (social-emotional) skills.
30	Being role models for healthy living keeps 4-H teens out of trouble after school.
31	Low-income youth increased their financial literacy.
32	Migrant farm workers made healthier food choices after nutrition education program.
33	Latino youth reported high levels on indicators of positive youth development (including competence, confidence, connections, empathy, character, and contribution)as a result of adapted models of 4-H programs designed to reach Latino children.
34	Latino youth become more confident in their science and engineering abilities as a result of collaborative 4-H youth development program.
35	Latino youth increase knowledge of and skills to engage with the government system.
36	Youth research resulted in fair changes to reduce biosecurity risks.

37	Youth showed increased interest in science and engineering.
38	Latino youth were inspired and motivated to pursue their higher education goals.
39	Weight gains in overweight Mexican-heritage children are slowed as a result of new culturally relevant obesity-prevention lessons.
40	Tribal children gained knowledge, skills and interest in healthy lifestyle habits.
41	Children reported to be drinking less soda and other sugary drinks.
42	4-H youth project results in two-thousand pounds of citrus donated to the community food bank.
43	Youth make healthier dietary choices.
44	Collaborative pilot project results in increased food options for the food insecure.
45	School board now plans to install multiple hydration stations during the school renovation project after hearing the presentation by the Project 4h20 teens.
46	Preschool sites implemented a policy change by providing guidelines to encourage parents to provide non-food contributions for school celebrations.
47	School gardens were revitalized, and others were maintained and expanded, as a result of nutrition education programs.
48	One Head Start preschool, that particularly excelled to change the culture and create a sustained environmental change, partnered with family services and two companies to build a new play yard and install a play structure to promote physical activity.

Outcome #1

1. **Outcome Measures**

   Low-income individuals and families, participating in nutrition and consumer education programs, gain knowledge of food resource management techniques.

   Not Reporting on this Outcome Measure

Outcome #2

1. **Outcome Measures**

   Low-moderate income individuals and families, participating in nutrition and consumer education programs, adopt recommended food resource management techniques.

2. **Associated Institution Types**

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	5214

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
703	Nutrition Education and Behavior

Outcome #3

1. Outcome Measures

Children and youth, participating in-school and afterschool educational programs, increase their level of science, agricultural and environmental literacy.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	846

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #4

1. Outcome Measures

Youth educators and child resource specialists, participating in youth development education programs, gain knowledge of youth development practices.

Not Reporting on this Outcome Measure

Outcome #5

1. Outcome Measures

Children and youth, participating in nutrition education programs, gain knowledge of nutrition.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	1075

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
703	Nutrition Education and Behavior

Outcome #6

1. Outcome Measures

Adults, participating in nutrition education programs, adopt recommended dietary practices.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	5490

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
703	Nutrition Education and Behavior

Outcome #7

1. Outcome Measures

Individuals, participating in nutrition education programs, adopt safe food handling and preparation techniques.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	3753

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
703	Nutrition Education and Behavior

Outcome #8

1. Outcome Measures

Youth educators and child resource specialists, participating in youth development education programs, adopt recommended youth development practices.

Not Reporting on this Outcome Measure

Outcome #9

1. **Outcome Measures**

Youth educators and program extenders, participating in the programs, including 4-H and SET, gain knowledge of best practices to extend science, engineering, and technology education and opportunities.

Not Reporting on this Outcome Measure

Outcome #10

1. **Outcome Measures**

Teachers, participating in health and nutrition programs, adopt recommended practices to prevent childhood obesity and foster a school environment that reinforces nutrition education.

Not Reporting on this Outcome Measure

Outcome #11

1. **Outcome Measures**

Community garden managers, non-profit agency personnel, small business owners, and low-income members of the public, participating in Master Gardener and other urban horticulture programs, gain knowledge about sustainable gardening practices.

2. **Associated Institution Types**

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	676

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
805	Community Institutions, Health, and Social Services

Outcome #12

1. Outcome Measures

Individuals participating in food safety education, gain knowledge of safe food handling, preparation, and preservation techniques.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	342

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
703	Nutrition Education and Behavior

Outcome #13

1. Outcome Measures

Percentage of 4-H youth (4th- 12th graders) make positive choices.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	84

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #14

1. Outcome Measures

Percentage of 4-H youth (4th- 12th graders) effectively communicate.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	83

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #15

1. Outcome Measures

Percentage of 4-H youth (4th- 12th graders) build connections.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	93

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #16

1. Outcome Measures

Percentage of 4-H youth (4th- 12th graders) apply content knowledge and skills in health, citizenship and science to contribute to the health, growth, and well-being of self, family, community, nation, and the world.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	89

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #17

1. Outcome Measures

Percentage of 4-H youth (4th- 12th graders) express interest and engage in science.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	85

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
In order for youth to be prepared for work and life, youth need to demonstrate interest and be engaged in science-related activities.

What has been done
Data on the national common measures was collected on around 500 youth in the California 4-H community club program. Youth ranged in age from 9 to 19 years old. The surveys were delivered via the California 4-H Online Record Book, a unique online platform programmed to mimic the traditional data collection from the paper record book forms but added two components: a social media-like interface and outcome surveys for program evaluation.

Results
Youth have demonstrated their interest and engagement in science by indicating that they: like to see how things are made or invented (91.7%), experimenting and testing ideas (91.3%), get excited about new discoveries (91.9%), and want to learn more about science (85.5%).

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #18

1. Outcome Measures

Percentage of 4-H youth (4th- 12th graders) express positive attitudes and aspirations toward science.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	65

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
In order for youth to be prepared for work and life, youth need to express positive attitudes about science, see science in their futures, and recognize the relevance of science.

What has been done
Data on the national common measures was collected on around 500 youth in the California 4-H community club program. Youth ranged in age from 9 to 19 years old. The surveys were delivered via the California 4-H Online Record Book, a unique online platform programmed to mimic the traditional data collection from the paper record book forms but added two components: a social media-like interface and outcome surveys for program evaluation.

Results
Youth have demonstrated their positive attitude and aspirations toward science by indicating that they: like science (88.2%), are good at science (86.8%), would like to have a job related to science (67.3%), do science activities that are not for school (67.7%), think science will be important in their future (grades 8-12 only: 82.1%), and think science is useful for solving everyday problems (grades 8-12 only: 90.7%).

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #19

1. Outcome Measures

Percentage of 4-H youth (4th- 12th graders) develop science skills and abilities.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	82

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
In order for youth to be prepared for work and life, youth need to demonstrate a capacity for science process skills.

What has been done
Data on the national common measures was collected on around 500 youth in the California 4-H community club program. Youth ranged in age from 9 to 19 years old. The surveys were delivered via the California 4-H Online Record Book, a unique online platform programmed to mimic the traditional data collection from the paper record book forms but added two components: a social media-like interface and outcome surveys for program evaluation.

Results
Youth have demonstrated a capacity for science process skills by indicating that they can: do experiment to answer a question (grade 4-7 only: 94%), tell others how to do an experiment (grades 4-7 only: 88.4%), explain why things happen in an experiment (grades 4-7 only: 86.9%), use scientific data to form a question (grades 8-12 only: 56.7%), design a scientific procedure to answer a question (grades 8-12 only: 64.4%), use data to create a graph for presentation to others (grades 8-12 only: 70.3%), create a display to communicate my data and observations (grades 8-12 only: 70.3%), and use science terms to share my results (grades 8-12 only: 67%).

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #20

1. Outcome Measures

Percentage of 4-H youth (8th-12th graders) apply learning, and make a contribution through science.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	90

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
In order for youth to be prepared for work and life, youth need to apply science skills to issues in their community.

What has been done
Data on the national common measures was collected on around 500 youth in the California 4-H community club program. Youth ranged in age from 9 to 19 years old. The surveys were delivered via the California 4-H Online Record Book, a unique online platform programmed to mimic the traditional data collection from the paper record book forms but added two components: a social media-like interface and outcome surveys for program evaluation.

Results
Youth have demonstrated the ability to apply science skills to issues in their community by indicating that they: have helped with a community service project that relates to science; for example: planted trees or gardens, road or stream clean-up, recycling (76.3%), used science tools to help in the community; for example: mapped with GIS, tested water quality (35.7%), taught others about science; for example: demonstrated, gave presentation at a community meeting or a school (70.3%), and organized or led science-related events; for example: science fair, environmental festival (37.3%).

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #21

1. Outcome Measures

Percentage of 4-H youth (4th- 12th graders) appreciate cultural diversity.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	91

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
In order for youth to be prepared for work and life, youth need to demonstrate value and respect for other cultures.

What has been done
Data on the national common measures was collected on around 500 youth in the California 4-H community club program.. Youth ranged in age from 9 to 19 years old. The surveys were delivered via the California 4-H Online Record Book, a unique online platform programmed to mimic the traditional data collection from the paper record book forms but added two components: a social media-like interface and outcome surveys for program evaluation.

Results
Youth have demonstrated appreciation of cultural diversity by indicating that they: enjoyed learning about people who are different from them (grades 4-7 only: 93.2%), explore cultural differences (grades 8-12 only: 90.2%), value learning about other cultures (grades 8-12 only: 92.2%), respect people from different cultures (grades 8-12 only: 98.1%), learned about people who are different from them (grades 8-12 only: 96.1%), and enjoy hosting someone from another culture (grades 8-12 only: 89.5%).

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #22

1. Outcome Measures

Percentage of 4-H youth (4th- 12th graders) engage in community and community issues.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	88

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
In order for youth to be prepared for work and life, youth need to engage in civic involvement, participate in community service and volunteer, demonstrate leadership efficacy, and maintain future intentions for civic engagement.

What has been done
Data on the national common measures was collected on around 500 youth in the California 4-H community club program.. Youth ranged in age from 9 to 19 years old. The surveys were delivered via the California 4-H Online Record Book, a unique online platform programmed to mimic the traditional data collection from the paper record book forms but added two components: a social media-like interface and outcome surveys for program evaluation.

Results
Youth have demonstrated their ability to engage in community and with community issues by indicating that they: can make a difference in my community through community service (94.4%), apply knowledge in ways that solve ?real-life? problems through community service (91.3%), gain skills through serving their community that will help them in the future (94.3%), are encouraged to volunteer more (94.6%), plan to work on projects to better their community (93.9%), continue to work to better their community after high school (grade 8-12 only: 93.2%), are interested in a career that helps others (grade 8-12 only: 93.2%), are interested in working in government (such as school board, Director of parks and rec, legislator, legislative aide intern), (grade 8-12 only: 57.7%), and can contact someone that had never met before to get their help with a problem (grade 8-12 only: 85.6%).

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #23

1. Outcome Measures

Percentage of 4-H youth (4th- 12th graders) have understanding of the democratic process.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	90

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
In order for youth to be prepared for work and life, youth need to demonstrate their ability to work effectively in teams, improve their knowledge of parliamentary procedure, increase their interactions with local, state and national government, and intend to vote.

What has been done
Data on the national common measures was collected on around 500 youth in the California 4-H community club program.. Youth ranged in age from 9 to 19 years old. The surveys were delivered via the California 4-H Online Record Book, a unique online platform programmed to mimic the traditional data collection from the paper record book forms but added two components: a social media-like interface and outcome surveys for program evaluation.

Results
Youth have demonstrated their ability to understand the democratic process by indicating that they: help make sure everyone gets an opportunity to say what they think (93.1%), treat everyone fairly and equally when they are in charge of a group (94.8%), and are able to lead a group in making a decision (grades 8-12 only: 98.1%).

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #24

1. Outcome Measures

Percentage of 4-H youth (8th-12th graders) have awareness of community and community issues.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	84

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
In order for youth to be prepared for work and life, youth need to demonstrate reading or viewing news regularly and identify important issues, and engage in discussion with others and be critical consumers of information.

What has been done
Data on the national common measures was collected on around 500 youth in the California 4-H community club program. Youth ranged in age from 9 to 19 years old. The surveys were delivered via the California 4-H Online Record Book, a unique online platform programmed to mimic the traditional data collection from the paper record book forms but added two components: a social media-like interface and outcome surveys for program evaluation.

Results
Youth have demonstrated their awareness of community and community issues by indicating that they: pay attention to news events that affect their community (82.7%), are aware of the important needs in their community (88.3%), care about their community (95.1%), talk to their friends about issues affecting their community, state, or world (86.6%), are interested in others' opinions about public issues (90.4%), listen to everyone's views whether they agree or not (93.2%), and try to figure out if they are just telling one side of the story when they hear about an issue (97.1%).

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #25

1. Outcome Measures

Percentage of 4-H youth (4th- 12th graders) choose food consistent with Dietary Guidelines.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	63

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
In order for youth to be prepared for work and life, youth need to demonstrate consumption of more healthy foods such as: vegetables, fruits, whole grains, fat-free or low-fat milk and milk products, seafood, lean meats and poultry, eggs, beans and peas, and nuts and seeds, and consume less unhealthy foods, such as: sodium, solid fats, added sugars, and refined grains, and follow healthy eating patterns such as: eating breakfast, eating as a family, and making healthy snack choices.

What has been done
Data on the national common measures was collected on around 500 youth in the California 4-H community club program. Youth ranged in age from 9 to 19 years old. The surveys were delivered via the California 4-H Online Record Book, a unique online platform programmed to mimic the traditional data collection from the paper record book forms but added two components: a social media-like interface and outcome surveys for program evaluation.

Results
Youth have demonstrated their choice in food is consistent with the dietary guidelines. By participating in a 4-H Healthy Living Program, youth learned about the foods that they should eat every day (95.8 %), what makes up a balanced diet (93.9%), why it is important for them to eat a healthful diet (96.0%), how to make healthful food choices (95.7%), how many calories they need to eat each day (grades 8-12 only: 72.5%), the importance of fruits and vegetables in their diet (grades 8-12 only: 94.2%), and the importance of whole grains in their diet (grades 8-12 only: 89.8 %). Youth grades 4-7 indicated that they: eat fruit for a snack (86.3%), eat vegetables for a snack (56.9%), choose water instead of soda pop or Kool Aid when they are thirsty (73.4%), drink 1% or skim milk instead of 2% or whole milk (61.3%), choose a small instead of a large order of French fries (67.6%), eat smaller servings of high fat foods like French fries, chips, snack cakes,

cookies or ice cream (49.3%), eat a low fat snack like pretzels instead of chips (68.1%), drink less soda pop (69.5%), and drink less Kool-Aid (89.2%).

4. Associated Knowledge Areas

KA Code	Knowledge Area
703	Nutrition Education and Behavior
806	Youth Development

Outcome #26

1. Outcome Measures

Percentage of 4-H youth (4th- 12th graders) improve physical activity practices.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	72

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
In order for youth to be prepared for work and life, youth need to understand the benefits of physical activity, engage in 60 minutes or more of physical activity, reduce sedentary activity, and balance food intake and physical activity.

What has been done
Data on the national common measures was collected on around 500 youth in the California 4-H community club program. Youth ranged in age from 9 to 19 years old. The surveys were delivered via the California 4-H Online Record Book, a unique online platform programmed to mimic the traditional data collection from the paper record book forms but added two components: a social media-like interface and outcome surveys for program evaluation.

Results
Youth have demonstrated their improvement in physical activity practices by indicating that they: do moderate physical activities like walking, helping around the house, raking leaves, or using the stairs (grades 4-7 only: 87.1%), believe being active is fun (grades 4-7 only: 87.2%), believe being active is good for them (98.1%), exercise 60 minutes every day (grades 4-7 only: 73.0%),

and believe physical activity will help them stay fit (grades 4-7 only: 97.2%). In addition, youth in grades 8 or higher reported that they: were physically active for a total of at least 60 minutes per day for 4 or more days during the past 7 days (69.4%), watched one hour or less of TV on an average school day (62.6%), and played video or computer games or use a computer for something that is not school work for one hour or less on an average school day (grades 8-12 only: 45.9%).

4. Associated Knowledge Areas

KA Code	Knowledge Area
724	Healthy Lifestyle
806	Youth Development

Outcome #27

1. Outcome Measures

Percentage of 4-H youth (4th- 12th graders) avoid and prevent negative risk behaviors.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	81

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
In order for youth to be prepared for work and life, youth need to demonstrate knowledge of risk prevention items, practice injury prevention behavior, prevent and reduce ATOD use such as practice refusal skills, intervening to prevent use/abuse, understand the consequences of risk behaviors, and advocate for avoiding risk behaviors among peers.

What has been done
Data on the national common measures was collected on around 500 youth in the California 4-H community club program. Youth ranged in age from 9 to 19 years old. The surveys were delivered via the California 4-H Online Record Book, a unique online platform programmed to mimic the traditional data collection from the paper record book forms but added two components: a social media-like interface and outcome surveys for program evaluation.

Results
Youth have demonstrated their ability to avoid and prevent negative risk behaviors by indicating that they: are safe and careful when they cook food (95.7%), ask an adult before taking medicine when they are sick (89.8%), use pedestrian crossing when crossing the road (91.8%), tell their friends when they think they are going to do something unsafe (93%), avoid using substances that could harm them (95%), wear a helmet when riding a bike (grades 4-7 only: 84.3%), wear a helmet when they rollerblade or ride a skateboard (grade 4-7 only: 84.4%), wear a helmet when they ride an All-Terrain Vehicle (grades 4-7 only: 84.9%), wear a seatbelt when riding in a car (grades 4-7: 98.5%; grade 8-12: 98%), avoid riding in cars with unsafe drivers (grades 4-7 only: 97%) and have not ridden in a car driven by someone who had been drinking alcohol (grades 8-12 only: 78.8%).

4. Associated Knowledge Areas

KA Code	Knowledge Area
724	Healthy Lifestyle
806	Youth Development

Outcome #28

1. Outcome Measures

Percentage who report having interpersonal skills such as teamwork and decision-making.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	80

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
In order for youth to be prepared for work and life, youth need to develop critical interpersonal skills to be successful in both the workplace and school settings.

What has been done
Data on the national common measures was collected on around 500 youth in the California 4-H community club program. Youth ranged in age from 9 to 19 years old. The surveys were delivered via the California 4-H Online Record Book, a unique online platform programmed to mimic the

traditional data collection from the paper record book forms but added two components: a social media-like interface and outcome surveys for program evaluation.

Results
Youth have demonstrated their interpersonal skills by indicating that they can: make decisions related to school or college (75.6%) and careers (72%), communicate effectively (80.3%), work with others to set goals and manage expectations (80%), and appreciate diversity in team members (85.5%).

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #29

1. Outcome Measures

Percentage who report having intrapersonal (social-emotional) skills.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	60

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
In order for youth to be prepared for work and life, youth need to develop critical social-emotional skills to be successful in both the workplace and school settings.

What has been done
Data on the national common measures was collected on around 500 youth in the California 4-H community club program. Youth ranged in age from 9 to 19 years old. The surveys were delivered via the California 4-H Online Record Book, a unique online platform programmed to mimic the traditional data collection from the paper record book forms but added two components: a social media-like interface and outcome surveys for program evaluation.

Results

Youth have demonstrated their interpersonal skills by indicating that they have: high self-esteem (83%), conscientiousness (60%), and a growth mindset (43%).

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #30

1. Outcome Measures

Being role models for healthy living keeps 4-H teens out of trouble after school.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The poor health status for Bay Point youth and families is a result of multiple risk factors: unhealthy weight; sedentary behaviors; limited access to affordable, healthy food; poverty; substance abuse; crime; and poor school performance. Thirty-six percent of students are at an unhealthy weight. Of the nineteen teens that attend Gateway Continuation High School, 63% identify as Latino, and 90% are socioeconomically disadvantaged. Engaging at-risk teens in an after school healthy living program can empower them to improve their health status.

What has been done
During 2014-2016, Contra Costa County's Children, Youth, and Families at Risk (CYFAR) program used positive youth development practices, youth-adult partnerships, and evidence-based curriculum to provide teens with healthy-living programming, leadership, and service-learning opportunities. Each school year, teens were recruited to participate in a semester-long culinary program to develop leadership, public speaking, and culinary skills while gaining nutrition knowledge and an appreciation for healthy food. The sessions featured recipes from different cultures, and the teens worked in teams to prepare and present the dishes to each other. During the second semester, the teens continued to meet twice a week to prepare healthy snacks, and they were trained to effectively deliver a six lesson nutrition series to third-grade students at a nearby school.

Results
The interactive design of the culinary sessions and the Teens as Teachers project kept the teens engaged in the program. They learned valuable life skills and were able to articulate the impact of the program on their life and the value of sharing what they learned with their friends, families, and the third graders. A semi-structured interview captured the teens' thoughts on working with children, setting goals for long-term health, and being a role model for healthy living. They reported positive changes in their eating habits and their school attendance and performance. The teens shared how they learned about cooking healthy food and how the program kept them busy and out of trouble after school. The CYFAR program helped the teens to become positive role models for healthy living.

4. Associated Knowledge Areas

KA Code	Knowledge Area
703	Nutrition Education and Behavior
806	Youth Development

Outcome #31

1. Outcome Measures

Low-income youth increased their financial literacy.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
People develop financial attitudes and behaviors at an early age and today's youth have significant spending power $211 billion a year in the US (http://www.statisticbrain.com/teenage-consumer-spending-statistics/). While youth are good at spending, various surveys on the financial literacy of teens, consistently report a grade of F or less than 69 percent. This issue is especially salient for limited-income youth and their families. From Tom Torlakson (California State Superintendent) to the US Mint, policy makers, and organizations have been drawing attention to the need to equip young people to be the competent financial consumers and managers of tomorrow. Multiple groups have recently developed curricula and programs to meet

this need. However, many programs are not research-based, so it is unclear if they lead to financial literacy.

What has been done
With the goal of increasing middle school youth financial literacy, UC Cooperative Extension Alameda 4-H, in collaboration with the East Bay Asian Local Development Center (EBALDC), developed, implemented, and evaluated a financial literacy curriculum called Money Savvy Youth (MSY). MSY is a 5-week in-school program delivered by program staff. We reached out to schools in limited- income areas of Oakland, CA. Twenty-five teachers from 11 schools participated. With their help, MSY was taught to 403 diverse youth (African-American = 31%, Hispanic = 29%) over a year. To measure program impacts, we adapted a post-test survey from the Council for Economic Education's Financial Fitness for Life curriculum and gathered pre, post, and follow-up surveys from the youth.

Results
We found that a 5-week financial literacy course, MSY, can increase 4th and 5th-grade youth financial literacy. Students gained a better understanding of topics like banking, saving, and making decisions about needs vs. wants. Comparing the pre- and post-test scores, 4th and 5th graders who took part in the program scored five times higher than youth who did not. Finally, we now have a research-based program that EBALDC will continue to use to reach limited-income youth.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #32

1. Outcome Measures

Migrant farm workers made healthier food choices after nutrition education program.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Migrant and seasonal farm labor workers are a vital component of the United States agricultural industry. Despite their important contributions, they are known to be a marginalized population who live in poverty, have limited access to health care services, are often malnourished, and have poor health indicators. UCCE CalFresh and EFNEP Specialists and Advisors from the Butte County Cluster, which includes Butte, Colusa, Sutter, Glenn, and Yuba Counties, had the resources to provide valuable information to this marginalized population.

What has been done
Butte County Cluster?s two nutrition programs, the Expanded Food and Nutrition Program (EFNEP) and the UC CalFresh Nutrition Education Program partnered to deliver a dual series-based presentation of curricula over an 8-week period. This collaborative lesson delivery approach took place in the heat of the summer at a 100-unit Migrant Farm Housing facility in Williams, CA. The participants were families (specifically mothers and their children) living at the Migrant Farm Housing. EFNEP staff facilitated adult lessons using the Eating Smart, Being Active curriculum and UC CalFresh staff facilitated the youth lessons using the Happy Healthy Me curriculum. The two programs collaborated to make it their goal during lesson delivery for both the parent and the child to be introduced to the same terminology and concepts so that they could have a common language at home. With less than ideal circumstances (hottest time of the day, limited access to facilities, and participants had already spent their day working out in the fields prior to attending these lessons in a facility without air conditioning), staff from the two programs wondered how successful their 8-week course would be, but against all odds, the program flourished and participants excelled.

Results
After facilitating lessons over an 8-week period, 92% of the adult participants graduated from EFNEP. Of these graduates, 78% reported eating more fruits, 22% reported eating more vegetables, and 44% reported increases in their physical activity levels. One educator also reported that with every week that went by, she received the greatest number of comments from the participants about their incremental changes than she has ever witnessed before in her work. These changes included: increasing fruit and vegetable consumption, decreasing the consumption of sugar sweetened beverages, and checking the nutrition facts labels on prepackaged foods.

4. Associated Knowledge Areas

KA Code	Knowledge Area
704	Nutrition and Hunger in the Population

Outcome #33

1. Outcome Measures

Latino youth reported high levels on indicators of positive youth development (including competence, confidence, connections, empathy, character, and contribution)as a result of adapted models of 4-H programs designed to reach Latino children.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Sonoma County is experiencing a demographic shift where the Latino population has increased by over 300% in the past 20 years. Nearly 37% of Sonoma County youth between age five and 18 identified as Latino, and yet, the Sonoma 4-H community is comprised of less than 10% Latino youth. 4-H Clubs have a long history of strengthening indicators of youth development, as well as providing education in science, engineering, technology, and mathematics (STEM), health, and civics. However, with projections for more diversity in the coming decade, 4-H programs must become culturally responsive and tailored to the needs and experiences of Latino youth.

What has been done
Sonoma County Cooperative Extension partnered with two local school districts to develop, implement, and evaluate adapted models of 4-H programs designed to reach Latino children. Programs incorporated culturally-responsive practices including bilingual instruction, relevant curriculum, involvement of local teenage mentors, opportunities for family involvement, and more conducive meeting times and locations. We chartered four 4-H Clubs, meeting during the afterschool hours at each elementary school, so they were more accessible to children at the school, instead of asking them to travel to another location. Additionally, we offered four weeks of summer day camps to children at these schools. Both programmatic models focused on core 4-H values of positive youth development, leadership development, healthy living, community service, and STEM. Led by local teenagers and parents, children were engaged in learning activities and sports as part of their 4-H experience. In LEGO-based activities, children completed challenges through teamwork and design thinking. In Civics, children learned about city planning, the law making process, and public transportation. Programs also offered fun sports activities like soccer, flag football, and basketball in a non-competitive environment to promote healthy living and sportsmanship.

Results
Sonoma 4-H increased its reach with Latino audiences over 90%, building each year from initially serving approximately 70 Latino youth to over 135. Evaluation results demonstrated that children felt a sense of belonging and reported high levels on indicators of positive youth development (including competence, confidence, connections, empathy, character, and contribution). Over 85% of children agreed they can handle problems that come up in their lives, 100% agreed it is important for them to do the right thing, and 92% agreed they care about contributing to making the world a better place for everyone. These two models of 4-H youth programming established their viability to reach and engage Latino youth and families, within 4-H core values, in long-term

youth development experiences. A toolkit was developed to help other counties replicate programming.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #34

1. Outcome Measures

Latino youth become more confident in their science and engineering abilities as a result of collaborative 4-H youth development program.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
With diversity increasing in Marin County, it is imperative to ensure access and equity to youth development programs, particularly for the 28% of youth who identify as Latino. Through funding support from the County of Marin, Cooperative Extension's 4-H Youth Development program could expand out-of-school science, technology, engineering and math (STEM) enrichment experiences, to reach a greater number of Latino youth both directly, through STEM activities, and indirectly, through curricular support and professional development of out-of-school staff.

What has been done
4-H responded by providing curricular support, professional development, and program delivery. We provided out-of-school program staff with research based curricular resources for STEM topics, health, and positive youth development concepts. We modified curriculum for staff who have limited resources and preparation time. Participating programs were given access to the Marin 4-H curriculum repository modified specifically for out-of-school programs. We offered professional development on STEM teaching methods and positive youth development to four organizations. In addition the in-class, experiential training, we visited staff during their activity sessions to provide feedback and recommendations and to listen to suggestions on how to

improve curriculum. Together, 4-H and the Bay Area Community Resources Learning Enrichment After-school Program (LEAP) implemented a pilot 4-H Club to serve San Pedro Elementary School students. Meeting once per week, and facilitated jointly by LEAP and 4-H staff, 26 youth experienced the new curriculum, "Thriving Youth, Flourishing Communities" targeting concepts in healthy habits, STEM, and civic engagement. Youth also learned record keeping using Google classroom, participated in a family event showcasing their developing communication skills, and enjoyed rewards and recognition for their efforts.

Results
In total, 4-H reached 1,395 youth, 97% of which identify as Latino, in 15 schools and programs. We provided development to 48 staff and provided curriculum for 64 activities for eight grade levels (1-8). Participating students showed increased confidence in their scientific ability. Eighty-five percent of students responded, "strongly agree" or "agree" with the statement "My scientific ability will grow the more I try" compared to 36% a year ago. Students also responded "strongly agree" or "agree" that they like science (72%), like to see how things are made or invented (85%), like to build or construct things (85%), and want to learn more about engineering (77%). Youth also reflected on their club experience and reported learning about building, science, plans, presenting, and demonstrating. Participating in the program made students feel proud, excited, happy, and glad. Participants shared that they improved at working with friends, listening and talking to people, and helped others by explaining, showing respect and sharing. 4-H has helped Latino youth become more confident in their science and engineering abilities and helped youth to see themselves as the scientists and engineers of the future.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #35

1. Outcome Measures

Latino youth increase knowledge of and skills to engage with the government system.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

In 2014, Latinos became the "new majority" in the state of California, with 14.99 million representing 38.75% of the total population (Los Angeles Times, July 2015). Latinos (Hispanics) are the nation's youngest major racial/ethnic group with an average age of 28 years old. Nearly half of U.S.-born Latinos are younger than 18 (Pew Research Center, 2016). California Latinos under age 18 now comprise 23.2% of the overall population (U.S. Census Quickfacts, 2016). Regrettably, Latinos continue to be underrepresented among voters compared to those eligible to vote and the overall population (Romero, 2016). Due to this new demographic for California and the United States, it is particularly important that Latino youth develop into engaged and informed citizens to respond to their increasing influence in the elections. Latino populations need to become more educated and more civic-minded.

What has been done

California is supporting and encouraging the participation of Latino youth in 4-H programs. California Focus (CalFocus) is one of these programs. CalFocus is a unique citizenship educational experience that combines hands-on participation workshops, debates, and simulations with outstanding speakers and historical, cultural, and government sites. The objective of CalFocus is for the 4-H members to experience California's government in action by participating in legislative, political, and judicial processes. California 4-H members between ages 14 to 19 are eligible to participate. Nonetheless, participation fees and travel costs are a limitation to attend this event. Recognizing the importance of Latino youth civic engagement, California 4-H Foundation raised funds to support twenty-eight Latino teenagers to attend CalFocus in 2016 and 2017. The Latino 4-H members selected for these awards were selected by the County 4-H Advisors and Program Representatives in each one of the UC ANR 4-H Latino Initiative counties (Sonoma, Merced, Monterey, Santa Barbara, Kern, Orange, and Riverside).

Results

With the funds raised by the CA 4-H Foundation and the support of the Legacy Foundation, fourteen youth attended in 2016 and fourteen in 2017, which marks the highest Latino attendance to this event. The evaluation shows that 96% of the youth attending expressed that they care about their country, and 92% are aware of the important needs of their community. The participants agree that this event helped them to engage and understand California's government system. Youth attending the conference reported increased skills and knowledge about their government and how to make a difference in their communities, including civic engagement, appreciation of cultural differences, and awareness of their communities.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #36

1. Outcome Measures

Youth research resulted in fair changes to reduce biosecurity risks.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
National and state agencies have identified biosecurity related to animal agriculture as a matter of high priority, and the United States Department of Agriculture has a long-term goal of safeguarding the animal production industry from outbreaks of animal disease (APHIS, 1998, 2010). Many 4-H Animal Science project animals are kept as part of backyard farms. Data collected during a study of California 4-H youth revealed the presence of numerous biosecurity risks. For example, 66% of project animals are housed in "backyard herds" with same or mixed species (Smith, 2009). Respondents indicated they traveled with their project animal to an average of two project meetings where mixing with other animals occurred and quarantine procedures were limited (Smith, 2009). These risks highlight the need to develop and provide education resources to 4-H youth, volunteers, and staff to help mitigate potential health and financial impacts.

What has been done
Participating in the UC ANR grant, "Mitigating Zoonotic and Animal Disease Risks in 4-H Animal Science Projects through Coordinated Education", Quail Creek and Scotts Valley 4-H members in Santa Cruz County developed knowledge and skills relative to mitigating livestock biosecurity and disease by using a three-phased education and sampling process. The first phase focused on educating youth about biosecurity and disease risk. In the second phase, the youth applied biosecurity practices at fairs and exhibitions. Fecal load assessments were taken at homes and fairs to compare the practices of youth receiving education compared to those who did not. In the third phase, participants identified the risks associated with fecal pathogen loads measured in animal samples collected at the fairs and developed biosecurity best-management practices for youth exhibitors.

Results

Participants in this project identified several risky practices at the Santa Cruz County fair developed solutions and presented their findings to the Fair Board. Of note was the potential for biosecurity risks to animals and humans relative to the location and poor drainage of the livestock wash stalls. Located in an area that is highly accessible to vehicles, strollers, fair-goers, and food delivery, the wash stalls create a potentially high risk of exposure to biosecurity problems to fair-goers. Participants presented their findings to the Fair Board along with potential solutions and associated costs. The findings have prompted the Fair Board to take action to address these risks.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #37

1. Outcome Measures

Youth showed increased interest in science and engineering.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Studies of informal science education programs have recommended emphasizing human versus technological aspects of science in curriculum design. Specifically, one study recommends "making STEM fields more attractive" to girls by "promoting science as a human inquiry, involving the hands and the heart as well as the brain, one's personal interests and tastes" rather than an anonymous application of a universal method" (Froschl, Sprung, Archer, & Fancsali, 2003). Additionally, research indicates that "New teaching and learning models are needed to provide students with the ability to engage in scientific inquiry" (Skelton, Seevers, Dormondy, & Hodnett, 2012). For both genders, hands-on experiences such as using tools and equipment have been found to enhance interest in science (Hansen, Walker, & Flom, 1995) and are related to higher math and science achievement (Campbell, Jolly, Hoey, & Perlman, 2002). Girls, in particular, were six times more likely to consider engineering as a career following hands-on engineering activities (Campbell & Shackford, 1990).

What has been done
Collaborating with National 4-H Council and the Pratt School of Engineering at Duke, the 4-H Youth Development program in San Benito, Monterey, and Santa Cruz counties provided professional development workshops, curriculum supplies, and technical support to deliver TechXcite curriculum modules in 4-H Community Club and afterschool programs. The TechXcite curriculum attracts boys, girls, rural, and urban students in afterschool programs to STEM fields and careers through engaging, substantive, and applicable, hands-on lessons. Ten sites reached over 160 youth with engineering curriculum focusing on prosthetic arms, infrared remote controls, solar-powered cars, harvesting rainwater, and imaging of biological systems during a nine-month period.

Results
Evaluation results generated by Compass Research and Evaluation indicated that 98% of instructors believe that students learned and demonstrated improved competence in science and engineering. Results also indicated that the modules are applicable to real-world situations (96%) and provided real-world examples and uses of technology (85%). With respect to gender differences, instructors very much or completely agreed that both male students (87%) and female students (72%) were engaged with TechXcite. Most instructors very much or completely agreed that after participating in TechXcite students showed improved attitudes toward science and engineering (65%), and increased initiative to explore science and engineering topics (64%).

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #38

1. Outcome Measures

Latino youth were inspired and motivated to pursue their higher education goals.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

In 2016, fifty-two percent of K-12 students in California were Latinos and 35 % between 18 and 24 years old were enrolled in a two or four-year college, up from 22% enrolled in 1993. However, only 15% of Latinos ages 25 to 29 had a bachelor's degree or higher (Pew Hispanic Research, 2016). A 2015 report from The Campaign for College Opportunity, stated that "among current Latino undergraduates, 65 percent attend a California community college but only 39 percent will earn a degree, a certificate, or transfer within six years in comparison with 53 percent of whites and the statewide average of 48 percent" (Daily News, 2015). Importantly, research also shows that millennials with a college degree are less likely than those without a college degree to be unemployed, 3.8% vs. 12.2% (Pew Research Center 2014). The UC ANR 4-H Latino Initiative, currently piloted in seven Counties, is working towards addressing the needs and building upon the strengths of Latino communities across California to foster higher education attainment through 4-H Youth Development programs.

What has been done

With the support of a small grant from the Thomas and Dorothy Leavey Foundation, the UC ANR 4-H Latino Initiative Team developed and implemented their first ever "Latino Career Day" at UC Davis. A total of 18 youth from five counties attended the event. It was planned and coordinated by Carol Garcia, 4-H Diversity and Expansion Program Representative in Monterey County and Lupita Fabregas, Assistant Director for 4-H Diversity and Expansion, with the support of Esther Rodriguez and Araceli Hernandez, from Kern and Orange counties. Students had the opportunity to speak with current UCD students in the Special Transitional Enrichment Program (STEP), the Latina Greek organization Lambda Theta Nu Sorority, Inc., and with faculty scholars from the Center for the Advancement of Multicultural Perspectives on Science (CAMPOS). Students were also led on a tour of the campus and learned about studying abroad.

Results

It was important for youth to meet individuals from similar backgrounds and realize that with hard work, perseverance and guidance, they are capable of attending and succeeding in college. For most students, this trip was their first with 4-H, for others, it was their first time on an airplane and their first hotel stay. Students were asked to complete a video interview and a written survey. One student learned that "college is a good thing because you get to explore and learn a lot" while another was "fascinated learning there are so many majors at UCD." The students enjoyed being with bilingual and bicultural colleagues from different parts of the state and with whom they could share their cultural and family values and concerns. Speaking with students and faculty members from a Latino background was very powerful; the students acknowledged that people "like them" are attending and succeeding in college. The first "Latino Career Day," which is part of 4-H Career Readiness programming, laid the groundwork for this important event to take place in the coming years.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #39

1. Outcome Measures

Weight gains in overweight Mexican-heritage children are slowed as a result of new culturally relevant obesity-prevention lessons.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Prevalence of childhood obesity is higher (22.4%) in Latino children ages 2-19 years than in non-Latino white children (14%). Though obesity rates have recently decreased among 2-5- year-olds nationwide, racial and ethnic health disparities persist and indicate the urgency of early prevention efforts in high-risk communities.

What has been done
In 2012, UC ANR specialists and advisors joined UC Davis faculty and students to conduct a childhood obesity prevention study in a rural community in California's Central Valley. Funded by the US Department of Agriculture, the Niños Sanos, Familia Sana, (Healthy Children, Healthy Family) was a three-year, community-based intervention that provided a monthly voucher to buy fruits and vegetables, an enhanced physical activity program at school, and nutrition education to Mexican-heritage parents with children ages 3-8 years old. A comparison community received non-nutrition related educational programs. The main goal of the intervention was to slow down weight gains in overweight, Mexican-heritage children, residing in an agricultural community. Other expected outcomes among children included increased consumption of fruit and vegetables and decreased consumption of high-fat, high-sugar foods. The UC ANR specialist and advisors developed culturally-adapted lessons in collaboration with the community and provided oversight of the parent nutrition education program over three years. UC CalFresh and the Expanded Food and Nutrition Education Program provided school- based nutrition education to intervention children. Five hundred and forty-four families and 700 eligible children participated in the study.

Results
This multifaceted, three-year, community-based intervention was effective in slowing weight gain in children who were obese at the beginning of the study. By the third year, obese boys and girls in the intervention community had significantly slower increases in body mass index than children

in the comparison community. Findings also show a significant decrease in the frequency of consuming energy dense foods (fast food and snack food items) among the intervention children but no change in comparison children (p <0.008). Interviews with the school staff in the intervention community revealed several important environmental changes, prompted by the NSFS program. This project also produced a culturally-adapted child obesity prevention curriculum, a policy brief on water quality, and a new validated tool for dietary assessment in Mexican-heritage pediatric populations.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #40

1. Outcome Measures

Tribal children gained knowledge, skills and interest in healthy lifestyle habits.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Forty percent of Coachella Valley children aged 2 to 17 are overweight or obese (2013, harcdata.org). Located in a remote area with limited access to fresh fruit and vegetables, the Torres Martinez Desert Cahuilla Indian Reservation covers 24,024 acres of desert spanning part of Coachella Valley and Imperial County, with an estimated population of 4,000. The tribal headquarters, in the unincorporated community of Thermal, is the location of the Temporary Assistance for Needy Families (TANF). TANF is charged with providing assistance and social support to families with children on the reservation. TANF Family Preservation Services, Youth Division was interested in nutrition education that would help children develop good eating habits and a healthy lifestyle.

What has been done
The UC CalFresh Nutrition Education Program in Riverside County teamed up with a tribal education guidance counselor to offer a summer enrichment program that teaches youth about

healthy foods. A series of nutrition classes for 1st and 2nd graders was offered six times during a three-week period in August 2016. A UC CalFresh nutrition educator trained the counselor to teach the "Good for Me and You!" curriculum and helped plan the classes. The classes were held in the tribal hall and with funds provided by TANF's Family Preservation Services the children received a healthy snack and a full lunch with each class. Youth learned how to make healthy recipes such as whole-wheat tortas. After the series of lessons concluded, the UC CalFresh Educator conducted a review of MyPlate with a short physical activity break. The group also played a spinning-wheel game where they named fruits and vegetables. The nutrition classes were promoted as the first in a series of healthy living sessions for TANF children and their families.

Results

While the program began with six students, it quickly grew to thirteen as the children brought friends and relatives. At the last class, a brief evaluation revealed that the children recognized MyPlate and were able to name and sort food models into appropriate groups. The children also indicated that they need to eat from all of the food groups, especially fruits and vegetables, to stay healthy. Lastly, they learned that keeping food safe is "good for me and you". The importance of food safety was illustrated by youth cleaning their hands at the table before and after meals, to "get rid of germs". The children enjoyed coming to these classes. Most indicated that trying new foods was their favorite part. The TANF Family Preservation Services manager said the program was so successful that the children were requesting more classes. Six months after the last class the attendees still knew all of the food groups on MyPlate. Several mentioned that they are now interested in nutrition as a profession. Plans are being developed to offer another nutrition enrichment program to tribal youth in 2017. UC CalFresh is currently working with the counselor to develop culturally appropriate nutrition information for their parents.

4. Associated Knowledge Areas

KA Code	Knowledge Area
703	Nutrition Education and Behavior
806	Youth Development

Outcome #41

1. Outcome Measures

Children reported to be drinking less soda and other sugary drinks.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Over the last four decades, rates of childhood obesity have more than tripled for school-aged youth. Sugar-sweetened beverage (SSB) intake contributes to excessive weight gain. Youth's risk for obesity increases an average of 60% with every additional daily serving of soda. In Shasta County 39% of children ages 2-17 consumed one or more SSBs daily and 33% were considered overweight or obese. The Dietary Guidelines for Americans encourage individuals to choose water as the best non-caloric substitute for SSBs. UCCE was ready to mobilize resources and partnerships to improve the health outcomes of Shasta County youth through education, marketing and promotion, and environmental changes that supported water consumption.

What has been done
UC ANR Advisors developed eight lessons focused on the health benefits of reducing SSBs and substituting healthier beverages, with an emphasis on tap water. The Team Up for Good Health lessons were delivered to 700 fourth- and fifth-grade students in five low-income schools in Shasta County during 2012-2014. One lesson each year was devoted to increasing the consumption of water. In year one, students learned how the body uses water, calculated their estimated water needs, identified sources of drinking water, and received reusable water bottles. During year two, students used marketing techniques to create posters promoting water consumption; funds were secured for the donation and installation of water refilling stations, a footprint stencil was used to create footsteps leading students to the water stations, and the number of bottles filled with water was recorded. Each lesson included a family letter that reinforced key messages and highlighted the student's chosen goal to increase water consumption. Events promoting tap water consumption were conducted in the schools and the community.

Results
The integrated education and environmental intervention was a successful approach to influence healthy behavior by surrounding students and families with consistent messaging to increase the consumption of tap water. Student questionnaires revealed that fewer participating students reported liking to drink soda at the end of the two-year study and more chose to drink water from school water stations as compared to the control students. Teachers reported that students brought fewer sodas and other sugary drinks to school. During the 2012-2013 school year, 35,783 bottles of water were filled representing cost savings to families of $15,029. UCCE partnerships with schools and community groups helped sustain the momentum, which potentially can improve health outcomes to reduce future health care costs for residents.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #42

1. Outcome Measures

4-H youth project results in two-thousand pounds of citrus donated to the community food bank.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Despite California's economic and agricultural prosperity, over one in four Californians are hungry or at serious risk of hunger, significantly worse than the nation as a whole. Hunger is a symptom of poverty; far too many families experience devastating health consequences when their low wages or modest public benefits cannot cover the cost of housing, utilities, and food (California Food Policy Advocates, 2013). In San Benito County, 20.1% of children live in food insecure households (Kids Count, 2014) and the U.S. Department of Agriculture in 2015 declared seven of eleven schools in the Hollister school district as Community Eligibility Provision sites, meaning breakfast and lunch have no cost for all students at the campuses as part of an effort to encourage students in high-poverty areas to take advantage of carefully balanced, nutritious meals.

What has been done
Modeled after an Urban Gleaning program in Portland Oregon, San Benito County 4-Her Claire Gastello coordinated an effort to glean unpicked citrus fruit from local homes throughout the city of Hollister and donate the harvested fruit to the local food pantry. The project was important to Gastello a nine-year 4-H member of the Cienega 4-H club "because it gave me a chance to give back to my community and develop leadership skills." Rather than seeing mature citrus fruit that has fallen to the ground go to waste, Claire did an environmental scan of the community to determine where unharvested fruit was available, worked with homeowners to obtain their consent to glean the fruit, and trained 4-H members and parents on how to properly use tools to safely conduct the harvest. With community service being a major focal point of the 4-H Youth Development Program, and with a monetary contribution from the San Benito County 4-H Council of $400.00, this project actively engaged 56 4-H members and adult volunteers in addressing food insecurity issues in San Benito County instead of just being passive receivers of information.

Results
The project reduced food waste by gleaning unused fruit and fed the hungry with two-thousand pounds of citrus through the community pantry that provides food security to over 9000 individuals annually. The 4-H youth lead also benefited: "I think the most important thing I learned from this project is organization. It takes a lot of effort and organization to make any event happen. I had to write a newspaper ad, knock on doors, and talk to the people in our community, and go to different [4-H] clubs to spread the word about my project. I also had to go to [4-H] Council twice. All of this took organization."

4. Associated Knowledge Areas

KA Code	Knowledge Area
704	Nutrition and Hunger in the Population
806	Youth Development

Outcome #43

1. Outcome Measures

Youth make healthier dietary choices.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Childhood obesity continues to be a problem across the United States. In 2015 the Centers for Disease Control reported that obesity affects one in six children and adolescents in the United States. Multi-faceted interventions have been suggested as one method for addressing the challenge of childhood obesity.

What has been done
The Center for Nutrition in Schools (CNS) and the UC CalFresh Nutrition Education Program partnered with the Sierra Foothill 4-H Food Smart Families program to implement the Shaping Healthy Choices Program (SHCP) at after-school program sites in Sutter and Yuba Counties throughout the 2015-2016 school year. The Food Smart Families program targets families eligible

for or receiving Supplemental Nutrition Assistance Program Education or Women Infants and Children benefits, and teaches them how to plan, shop, and prepare healthy meals on a budget. The SHCP is a comprehensive, multicomponent, school-based intervention that was developed to improve children's health. The Food Smart Families program utilized a youth engagement extender model to implement ten lessons from the SHCP curricula throughout the school year. Specifically, local 4-H teens were recruited and trained to assume leadership roles and facilitate the program using the "4-H Teens as Teachers" method. They led multiple after-school programs in the Marysville and Yuba City Unified School Districts. The SHCP learner-centered curricula includes both Discovering Healthy Choices, which is a garden-enhanced nutrition curriculum and Cooking up Healthy Choices, which highlights seasonal produce and allows students to experience cooking demonstrations using all five of their senses.

Results

This partnership between the CNS, UC CalFresh, and the 4-H Food Smart Families Program provided the opportunity for collaboration between the three programs, as well as the opportunity for teens to exercise leadership skills through youth-adult partnerships (YAP). 4-H Extension Educators led three YAP sessions for teen instructors where they learned how to work together in the classroom so students would benefit the most from this program. The teens also received two additional days of training that focused on curricula delivery, inquiry-based teaching methods, and classroom management techniques. After participating in ten lessons, 91% of students reported that they learned how to make healthy food choices, 87% of students indicated that they eat more fruits and vegetables, and 66% of students reported that they eat less junk food. The percentage of students that said they choose healthy snacks most days or every day also increased by 14%.

4. Associated Knowledge Areas

KA Code	Knowledge Area
703	Nutrition Education and Behavior
806	Youth Development

Outcome #44

1. Outcome Measures

Collaborative pilot project results in increased food options for the food insecure.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual

2017 0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Food security is defined as "having reliable access to a sufficient quantity of affordable, nutritious food." Sixteen percent of adults and 23% of children struggled with food security in Yolo County in 2015. According to a 2012 First 5 community needs assessment, food access and nutrition information was paramount to families with young children in Yolo County. Food insecurity can increase the risk of obesity, poor school performance, low self-esteem, illness and other maladies. At the same time, Yolo grows some of the most diverse and abundant crops in the world. A component of food waste is the produce left behind in the fields due to overproduction or the inability to sell the food due to inconsistencies in size, shape, or color due to regulations and processing requirements. There is a unique opportunity to draw on local crop waste to repurpose fruits and vegetables to meet the needs of residents.

What has been done

The UC Davis Innovation Institute for Food and Health spearheaded a collaborative effort to test the process of gleaning crop waste, preserving it, and then distributing it through the local food bank in consumer-friendly packaging. Under the coordination of the Family Huie organization, UC ANR provided expertise on community nutrition practices, dietary needs, preferences, and cultural customs in order to deliver palatable, nutrient dense, shelf-stable products to low-income families with young children. Household cooks with children under the age of five who utilize the Food Bank in four small rural towns (Madison, Arbuckle, Dunnigan, and Knights Landing) were invited to participate in the project. Eighty participants completed a survey on preferences. Participants were then asked to submit a recipe utilizing the selected crop products (canned, pickled, and dried tomatoes) and rice (an abundant ingredient at the food bank). Finalists were selected and invited to the UC Davis Food Innovation Lab to participate in a cooking competition to choose the winning recipes.

Results

As a result of this project, local, primarily Latina women, contributed to the project, increasing the quality and acceptability of shelf-stable food products available through the Yolo Food Bank. Their inclusion resulted in the development of recipes that will increase the use of fruits and vegetables in home cooking during months when fresh produce is scarce. Additionally, this was a pilot project that was shown to be an effective model. Future funding will increase the variety used and will help to increase food security and nutrition.

4. Associated Knowledge Areas

KA Code	Knowledge Area
704	Nutrition and Hunger in the Population

Outcome #45

1. Outcome Measures

School board now plans to install multiple hydration stations during the school renovation project after hearing the presentation by the Project 4h20 teens.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
703	Nutrition Education and Behavior
806	Youth Development

Outcome #46

1. Outcome Measures

Preschool sites implemented a policy change by providing guidelines to encourage parents to provide non-food contributions for school celebrations.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	11

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
703	Nutrition Education and Behavior

Outcome #47

1. Outcome Measures

School gardens were revitalized, and others were maintained and expanded, as a result of nutrition education programs.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	6

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
704	Nutrition and Hunger in the Population
806	Youth Development

Outcome #48

1. Outcome Measures

One Head Start preschool, that particularly excelled to change the culture and create a sustained environmental change, partnered with family services and two companies to build a new play yard and install a play structure to promote physical activity.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
724	Healthy Lifestyle

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Populations changes (immigration, new cultural groupings, etc.)

Brief Explanation

V(I). Planned Program (Evaluation Studies)

Evaluation Results

UC ANR's quantitative and qualitative outcomes recorded from the evaluation studies are reported under the State Defined Outcomes section.

Key Items of Evaluation

The Report Overview's Federal Planned Program summary of accomplishments highlights UC ANR's most notable research and extension examples from FY 2017. In addition, under the Federal Planned Programs State Defined Outcomes section, the significant success stories are reported as qualitative outcomes.

V(A). Planned Program (Summary)

Program # 2

1. Name of the Planned Program

Sustainable Food Systems

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
102	Soil, Plant, Water, Nutrient Relationships	16%		5%	
111	Conservation and Efficient Use of Water	4%		1%	
201	Plant Genome, Genetics, and Genetic Mechanisms	1%		18%	
202	Plant Genetic Resources	3%		5%	
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants	4%		6%	
204	Plant Product Quality and Utility (Preharvest)	6%		2%	
205	Plant Management Systems	34%		3%	
206	Basic Plant Biology	1%		15%	
212	Pathogens and Nematodes Affecting Plants	2%		6%	
302	Nutrient Utilization in Animals	2%		6%	
307	Animal Management Systems	10%		1%	
501	New and Improved Food Processing Technologies	1%		5%	
502	New and Improved Food Products	1%		2%	
503	Quality Maintenance in Storing and Marketing Food Products	3%		2%	
511	New and Improved Non-Food Products and Processes	1%		3%	
601	Economics of Agricultural Production and Farm Management	5%		5%	
603	Market Economics	2%		4%	
606	International Trade and Development Economics	0%		3%	
702	Requirements and Function of Nutrients and Other Food Components	0%		6%	
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins	4%		2%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2017	Extension		Research	
	1862	1890	1862	1890
Plan	10.3	0.0	16.2	0.0

Actual Paid	15.6	0.0	15.2	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
2643852	0	2200533	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
2643852	0	2200533	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
40545512	0	85156877	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

UC ANR's integrated research and extension activities will conduct research projects, workshops, classes. and demonstrations, as well as one-on-one interventions. In addition, the programs will use PSAs, newsletters, mass media, web sites, and collaborations with other agencies and organizations to create and deliver programs.

2. Brief description of the target audience

- Food producers (e.g., farmers/ranchers and rangeland owners/operators/managers, including conventional, organic, small and large producers)
- Agricultural advising professionals (e.g.. Pest Control Advisors, crop advisors, landscape professionals)
- Allied industry companies including seed and supply companies
- Food processors, handlers, retailers, and suppliers
- Public regulatory agencies and private non-profit advocacy groups
- Food consumers, members of the general public

3. How was eXtension used?

UC ANR academics used eXtension to participate in and contribute to Communities of Practice, to answer "Ask an Expert" questions, and for other networking purposes.

V(E). Planned Program (Outputs)

1. Standard output measures

2017	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	213627	0	199	0

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year: 2017

Actual: 8

Patents listed

GLK GENES FOR IMPROVED FRUIT QUALITY

DROUGHT-RESISTANT PLANTS

ALMOND TREE NAMED 'KESTER'

TRANSGENIC PLANTS COMPRISING A MUTANT PHYTOCHROME AND SHOWING ALTERED PHOTOMORPHOGENESIS

METHOD FOR DEBITTERING OLIVES

STRAWBERRY PLANT NAMED 'CABRILLO' ('CN236')

USE OF A NATURAL METABOLITE TO INCREASE CROP PRODUCTION

MODIFIED PYR/PYL RECEPTORS ACTIVATED BY ORTHOGONAL LIGANDS

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2017	Extension	Research	Total
Actual	86	459	545

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Classes/Short Courses Conducted

Year	Actual
2017	161

Output #2

Output Measure

- Workshops Conducted

Year	Actual
2017	364

Output #3

Output Measure

- Demonstrations and Field Days Conducted

Year	Actual
2017	59

Output #4

Output Measure

- Newsletters Produced
  Not reporting on this Output for this Annual Report

Output #5

Output Measure

- Web Sites Created or Updated

Year	Actual
2017	71

Output #6

Output Measure

- Research Projects Conducted

Year	Actual
2017	299

Output #7

Output Measure

- Videos, Slide Sets and other A/V or Digital Media Educational Products Created

Year	Actual
2017	48

Output #8

Output Measure

- Manuals and Other Printed Instructional Materials Produced

Year	Actual
2017	48

Output #9

Output Measure

- Popular Articles

Year	Actual
2017	94

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Farm and ranch owners/managers and allied industry professionals, participating in the programs, gain knowledge of crop and varietal selection factors and research-based performance data.
2	Farm and landscaping owners/managers and allied industry professionals, participating in the programs, gain knowledge of cultural practices and other aspects of comprehensive management systems for plant production.
3	Farm and ranch owners/managers, participating in the programs, gain knowledge of business management practices and marketing strategies, including the costs and risks associated with producing specialty crops.
4	Farm and ranch owners/managers, participating in the programs, gain skills in business management practices.
5	Farm and landscaping owners/managers and allied industry professionals, participating in the programs, gain knowledge of pest and disease management for plant production.
6	Farm and landscaping owners/managers and allied industry professionals, participating in the programs, gain knowledge of irrigation management and drainage.
7	Farm and landscaping owners/managers and allied industry professionals, participating in the program, gain skills to improve comprehensive management systems for plant production.
8	Farm and ranch owners/managers and allied industry professionals, participating in food safety programs, gain knowledge on on-farm control of food contaminants and quality assurance programs.
9	Ranch owners/managers and allied industry professionals, participating in the programs, gain knowledge of aspects of comprehensive management systems for animal production.
10	Farm owners/managers and allied industry professionals, participating in the programs, are more likely to try out or adopt recommended cultural practices or other aspects of comprehensive management systems for plant production.
11	Farm and landscaping owners/managers and allied industry professionals participating in the program gain knowledge of aspects of plant nutrition management.
12	Ranch owners/managers and allied industry professionals, participating in the program, gain skills to improve comprehensive management systems for animal production.
13	Ranch owners/managers and allied industry professionals, participating in the programs, are more likely to try out or adopt recommended practices or other aspects of comprehensive management systems for animal production.
14	National priority outcome indicator: number of participants adopting best practices and technologies resulting in increased yield, reduced inputs, increased efficiency, increased, increased economic return, and/or conservation of resources.
15	Specialty coffee production and marketing offers a promising new crop alternative for several mild-winter counties in California.
16	Research informs pesticide regulations aimed to improve public health.

Outcome #1

1. Outcome Measures

Farm and ranch owners/managers and allied industry professionals, participating in the programs, gain knowledge of crop and varietal selection factors and research-based performance data.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	506

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
202	Plant Genetic Resources
204	Plant Product Quality and Utility (Preharvest)

Outcome #2

1. Outcome Measures

Farm and landscaping owners/managers and allied industry professionals, participating in the programs, gain knowledge of cultural practices and other aspects of comprehensive management systems for plant production.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	1086

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems
206	Basic Plant Biology
601	Economics of Agricultural Production and Farm Management

Outcome #3

1. Outcome Measures

Farm and ranch owners/managers, participating in the programs, gain knowledge of business management practices and marketing strategies, including the costs and risks associated with producing specialty crops.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	810

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
601	Economics of Agricultural Production and Farm Management

Outcome #4

1. Outcome Measures

Farm and ranch owners/managers, participating in the programs, gain skills in business management practices.

Not Reporting on this Outcome Measure

Outcome #5

1. Outcome Measures

Farm and landscaping owners/managers and allied industry professionals, participating in the programs, gain knowledge of pest and disease management for plant production.

Not Reporting on this Outcome Measure

Outcome #6

1. Outcome Measures

Farm and landscaping owners/managers and allied industry professionals, participating in the programs, gain knowledge of irrigation management and drainage.

Not Reporting on this Outcome Measure

Outcome #7

1. **Outcome Measures**

Farm and landscaping owners/managers and allied industry professionals, participating in the program, gain skills to improve comprehensive management systems for plant production.

Not Reporting on this Outcome Measure

Outcome #8

1. **Outcome Measures**

Farm and ranch owners/managers and allied industry professionals, participating in food safety programs, gain knowledge on on-farm control of food contaminants and quality assurance programs.

Not Reporting on this Outcome Measure

Outcome #9

1. **Outcome Measures**

Ranch owners/managers and allied industry professionals, participating in the programs, gain knowledge of aspects of comprehensive management systems for animal production.

2. **Associated Institution Types**

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	391

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
302	Nutrient Utilization in Animals
307	Animal Management Systems
601	Economics of Agricultural Production and Farm Management

Outcome #10

1. Outcome Measures

Farm owners/managers and allied industry professionals, participating in the programs, are more likely to try out or adopt recommended cultural practices or other aspects of comprehensive management systems for plant production.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	148

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems
307	Animal Management Systems

Outcome #11

1. **Outcome Measures**

Farm and landscaping owners/managers and allied industry professionals participating in the program gain knowledge of aspects of plant nutrition management.

Not Reporting on this Outcome Measure

Outcome #12

1. **Outcome Measures**

Ranch owners/managers and allied industry professionals, participating in the program, gain skills to improve comprehensive management systems for animal production.

Not Reporting on this Outcome Measure

Outcome #13

1. **Outcome Measures**

Ranch owners/managers and allied industry professionals, participating in the programs, are more likely to try out or adopt recommended practices or other aspects of comprehensive management systems for animal production.

Not Reporting on this Outcome Measure

Outcome #14

1. **Outcome Measures**

National priority outcome indicator: number of participants adopting best practices and technologies resulting in increased yield, reduced inputs, increased efficiency, increased, increased economic return, and/or conservation of resources.

2. **Associated Institution Types**

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	610

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
202	Plant Genetic Resources
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems
307	Animal Management Systems
601	Economics of Agricultural Production and Farm Management

Outcome #15

1. Outcome Measures

Specialty coffee production and marketing offers a promising new crop alternative for several mild-winter counties in California.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Farm operators in California are often faced with limited market alternatives for traditional fruit and vegetable crops because of chronic oversupply and low prices. The development of promising new crops is one way to expand the range of options available to California farmers who want to

increase the diversity of crops they grow and improve farm profitability. Specialty coffee production and marketing fetches a premium and does not need a lot of water. The market demand for specialty coffee has also continued to expand in the US following on exceptional growth over more than 20 years. Until recently, American coffee was grown commercially only in Hawaii. More research is needed to explore and expand the specialty coffee production and marketing opportunity for the frost-free areas of central and southern California.

What has been done
UCCE continued to research in collaboration with commercial growers. Coffee variety research trials identified varieties that are suitable for production in California. A multi-year, on-farm research and development program with the goal of producing a profitable, high-quality, specialty coffee evaluated alternative cultural practices to produce a consistent crop. With the elements of coffee production and processing taking shape, different marketing options including farmer's market, farm tours, and internet sales were explored.

Results
These efforts led to a slow, steady increase in the planting area and the range of varieties, followed by successful sales of processed coffee beginning in 2010. Coffee plantings have continued on additional farms during 2017 with approximately 30,000 coffee trees now established on 24 farm sites from Morro Bay to San Diego, with production concentrated in Santa Barbara, Ventura and San Diego counties. Coffee from California farms has now been successfully produced, processed, and commercially marketed. In the foreseeable future there is potential for future growth, given the market interest and demand in California specialty coffee continue to outpace the new production.

4. Associated Knowledge Areas

KA Code	Knowledge Area
601	Economics of Agricultural Production and Farm Management

Outcome #16

1. Outcome Measures

Research informs pesticide regulations aimed to improve public health.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
California has over one million acres planted in almonds. Replanted orchards are treated with pre-plant soil fumigants to control soil borne pests. Totally impermeable film (TIF) can substantially reduce fumigant emissions by retaining fumigants under the tarp. In annual crops, TIF has shown promise in controlling emissions and improving fumigant distribution in soil; but, research was needed to evaluate TIF benefits in perennial crops like almonds.

What has been done
A collaborative project with USDA and UCCE conducted research, outreach and education showing how utilizing totally impermeable film (TIF) is effective in managing almond replant problems, and leads to a reduction in total fumigant applied and emissions. A research update on soil fumigation and alternatives was provided at the California Almond Board's 2017 California Almond Conference; there close 250 attendees. In addition, for the West Coast Nut Growers' Mid-Valley Nut Conference an educational presentation on the use of soil fumigants in managing almond replant problems was given to over 100 attendees.

Results
The TIF research was utilized by the California Department of Pesticide Regulation to develop buffer zone regulations, which will reduce pesticide emissions near public schools and daycare facilities. The regulations can help improve public health statewide by limiting human exposure to pesticides.

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems
212	Pathogens and Nematodes Affecting Plants

V(H). Planned Program (External Factors)

External factors which affected outcomes
- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Populations changes (immigration, new cultural groupings, etc.)

Brief Explanation

V(I). Planned Program (Evaluation Studies)

Evaluation Results

UC ANR's quantitative and qualitative outcomes recorded from the evaluation studies are reported under the State Defined Outcomes section.

Key Items of Evaluation

The Report Overview's Federal Planned Program summary of accomplishments highlights UC ANR's most notable research and extension examples from FY 2017. In addition, under the Federal Planned Programs State Defined Outcomes section, the significant success stories are reported as qualitative outcomes.

V(A). Planned Program (Summary)

Program # 3

1. Name of the Planned Program

Sustainable Natural Ecosystems

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
101	Appraisal of Soil Resources	2%		5%	
102	Soil, Plant, Water, Nutrient Relationships	4%		17%	
111	Conservation and Efficient Use of Water	7%		3%	
112	Watershed Protection and Management	6%		2%	
121	Management of Range Resources	26%		4%	
122	Management and Control of Forest and Range Fires	4%		1%	
123	Management and Sustainability of Forest Resources	14%		3%	
131	Alternative Uses of Land	3%		2%	
132	Weather and Climate	3%		6%	
133	Pollution Prevention and Mitigation	2%		6%	
135	Aquatic and Terrestrial Wildlife	2%		10%	
136	Conservation of Biological Diversity	10%		12%	
141	Air Resource Protection and Management	5%		7%	
201	Plant Genome, Genetics, and Genetic Mechanisms	0%		3%	
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants	1%		2%	
211	Insects, Mites, and Other Arthropods Affecting Plants	0%		3%	
311	Animal Diseases	0%		2%	
605	Natural Resource and Environmental Economics	4%		7%	
610	Domestic Policy Analysis	1%		4%	
903	Communication, Education, and Information Delivery	6%		1%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2017	Extension		Research	
	1862	1890	1862	1890
Plan	9.6	0.0	9.6	0.0
Actual Paid	9.6	0.0	8.0	0.0
Actual Volunteer	17.0	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
1544688	0	945960	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
1544688	0	945960	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
12057941	0	60226893	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

UC ANR's integrated research and extension activities will conduct research projects, workshops, classes, and demonstrations, as well as one-on-one interventions. In addition, the programs will use PSAs, newsletters, mass media, web sites, and collaborations with other agencies and organizations to create and deliver programs.

2. Brief description of the target audience

- Farmers
- Ranchers
- Inland fishery owners/operators
- Governmental agencies
- Agricultural and fishing organizations
- Owners/managers of private and public rangeland, forest, and wildlands
- Community organizations
- Resource managers

3. How was eXtension used?

UC ANR academics used eXtension to participate in and contribute to Communities of Practice, to answer "Ask an Expert" questions, and for other networking purposes.

V(E). Planned Program (Outputs)

1. Standard output measures

2017	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	57215	0	0	0

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year: 2017

Actual: 1

Patents listed

Methods for Producing Authigenic Rock Mineral for Altering Rock Hydrology

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2017	Extension	Research	Total
Actual	82	324	406

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Classes/Short Courses Conducted

Year	Actual
2017	75

Output #2

Output Measure

- Workshops Conducted

Year	Actual
2017	32

Output #3

Output Measure

- Demonstrations and Field Days Conducted

Year	Actual
2017	10

Output #4

Output Measure

- Newsletters Produced
  Not reporting on this Output for this Annual Report

Output #5

Output Measure

- Web Sites Created or Updated

Year	Actual
2017	8

Output #6

Output Measure

- Research Projects Conducted

Year	Actual
2017	140

Output #7

Output Measure

- Videos, Slide Sets and Other AV or Digital Media Educational Products Created

Year	Actual
2017	3

Output #8

Output Measure

- Manuals and Other Printed Instructional Materials Produced

Year	Actual
2017	9

Output #9

Output Measure

- Popular Articles

Year	Actual
2017	20

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Farm, ranch, private and public forest and wildland owners/mangers, participating in natural resource management programs, gain knowledge of strategies and techniques for sustainable use of natural resources.
2	Fire protection and land management agencies, land and home owners, community organizations, and landscape professionals, participating in wildland fire education programs, gain knowledge on how to increase fire resistance of homes and landscaping.
3	Farm, ranch, and landscape owners/managers and allied industry professionals and governmental agency representatives, participating in air quality education programs, gain knowledge of the atmospheric system and/or how policies, products, plants, and practices can help improve air quality.
4	Ranch and private and public rangeland owners/managers, participating in rangeland management programs, gain knowledge of recommended techniques for rangeland monitoring and management, and grazing and browsing.
5	Ranch and private and public rangeland owners/managers, participating in the programs, adopt recommended techniques for rangeland monitoring and management, and grazing and browsing.
6	Farm owners/managers and allied industry professionals participating in soil quality education programs, gain knowledge of soil conditions and management practices to improve soil health.
7	Forest landowners and agency personnel gain knowledge of management and sustainability for forest resources.
8	Owners/managers of private and public lands, participating in sustainable natural ecosystem education programs, will adopt recommended strategies and techniques for sustainable use of natural resources.
9	California Naturalists provide environmental stewardship volunteer service that has economic value for the state.
10	Fire protection and land management agencies, land and home owners, community organizations, and landscape professionals, participating in wildland fire education programs, gained knowledge on how to manage their properties with prescribed fire.

Outcome #1

1. Outcome Measures

Farm, ranch, private and public forest and wildland owners/mangers, participating in natural resource management programs, gain knowledge of strategies and techniques for sustainable use of natural resources.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	476

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
123	Management and Sustainability of Forest Resources
135	Aquatic and Terrestrial Wildlife
136	Conservation of Biological Diversity

Outcome #2

1. Outcome Measures

Fire protection and land management agencies, land and home owners, community organizations, and landscape professionals, participating in wildland fire education programs, gain knowledge on how to increase fire resistance of homes and landscaping.

Not Reporting on this Outcome Measure

Outcome #3

1. Outcome Measures

Farm, ranch, and landscape owners/managers and allied industry professionals and governmental agency representatives, participating in air quality education programs, gain knowledge of the atmospheric system and/or how policies, products, plants, and practices can help improve air quality.

Not Reporting on this Outcome Measure

Outcome #4

1. Outcome Measures

Ranch and private and public rangeland owners/managers, participating in rangeland management programs, gain knowledge of recommended techniques for rangeland monitoring and management, and grazing and browsing.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	366

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
121	Management of Range Resources

Outcome #5

1. Outcome Measures

Ranch and private and public rangeland owners/managers, participating in the programs, adopt recommended techniques for rangeland monitoring and management, and grazing and browsing.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	195

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
121	Management of Range Resources

Outcome #6

1. Outcome Measures

Farm owners/managers and allied industry professionals participating in soil quality education programs, gain knowledge of soil conditions and management practices to improve soil health.

Not Reporting on this Outcome Measure

Outcome #7

1. Outcome Measures

Forest landowners and agency personnel gain knowledge of management and sustainability for forest resources.

Not Reporting on this Outcome Measure

Outcome #8

1. Outcome Measures

Owners/managers of private and public lands, participating in sustainable natural ecosystem education programs, will adopt recommended strategies and techniques for sustainable use of natural resources.

Not Reporting on this Outcome Measure

Outcome #9

1. Outcome Measures

California Naturalists provide environmental stewardship volunteer service that has economic value for the state.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
California's ecosystems are at a critical juncture. Population expansion continues throughout California with the majority of the 40 million residents concentrated in megacities. Fewer Californians have connections to the farms that produce our food or ready access to natural ecosystems. Balancing the competing demands for water and land resources is becoming increasingly difficult and complex. This threatens California's unique biodiversity and ecosystem goods and services that our economy and well-being depend on. Addressing the challenge of

conservation and sustainable management of our natural resources requires an engaged and environmentally literate public. The California Naturalist program developed the UC branded California Naturalist curriculum, but then faced a bigger challenge in developing a program delivery approach that could 1) scale up quickly to achieve statewide coverage, 2) involve cost recovery to improve long-term sustainability, 3) ensure consistent delivery while at the same time allowing content to be tailored to local ecosystems and environmental issues, 4) get off the ground with a minimal initial investment, and 5) build on the existing work of others in the field of naturalist training.

What has been done

The program developed an approach to program delivery that integrated three delivery models: 1) collective impact, 2) social franchise, and 3) train-the-trainer. By adopting a "collective impact framework", the California Naturalist program built on shared goals and interests by engaging with existing - yet isolated - local organizations that operate in the environmental education and natural history training space. As the "backbone organization" the California Naturalist program provided content, coordination, and the certification infrastructure to sustain the effort. This infrastructure is analogous to a franchise model where all the program partners are independent entities, yet all deliver the same course. At the heart of this approach is a train-the-trainer model, where qualified instructors from partner organizations are trained to deliver the course in a manner that ensures continuity across partners yet allows each partner to tailor the program to the local ecosystems, issues, and audiences in their region.

Results

In 2017, the California Naturalist Program was awarded the Outstanding Team Award from the Alliance of Natural Resource Outreach and Service Programs. This recognition was partially a result of the integrated and collaborative program delivery approach that had positive impacts at multiple levels from partner organizations, to course instructors, to the trained naturalists and the people they reached. Within five years, the program established partnership agreements with 40 organizations including park associations, museums, university research stations, land trusts, community colleges, conservation corps programs and others. The program currently has over 65 active instructors trained in the delivery of the California Naturalist course which has been taught over 130 times in different locations around the state including eight of the state?s ten bioregions. As of the end of 2017, over 2,300 participants have been trained through the program, and have recorded over 99,000 hours of volunteer service with an estimated value of $2.7 million for the state of California.

4. Associated Knowledge Areas

KA Code	Knowledge Area
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
121	Management of Range Resources
123	Management and Sustainability of Forest Resources
135	Aquatic and Terrestrial Wildlife
136	Conservation of Biological Diversity

Outcome #10

1. Outcome Measures

Fire protection and land management agencies, land and home owners, community organizations, and landscape professionals, participating in wildland fire education programs, gained knowledge on how to manage their properties with prescribed fire.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	270

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
122	Management and Control of Forest and Range Fires

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Populations changes (immigration, new cultural groupings, etc.)

Brief Explanation

{No Data Entered}

V(I). Planned Program (Evaluation Studies)

Evaluation Results

{No Data Entered}

Key Items of Evaluation

{No Data Entered}

V(A). Planned Program (Summary)

Program # 4

1. Name of the Planned Program

Endemic and Invasive Pests and Diseases

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
101	Appraisal of Soil Resources	0%		1%	
102	Soil, Plant, Water, Nutrient Relationships	1%		0%	
111	Conservation and Efficient Use of Water	0%		1%	
123	Management and Sustainability of Forest Resources	1%		0%	
135	Aquatic and Terrestrial Wildlife	2%		2%	
136	Conservation of Biological Diversity	1%		2%	
201	Plant Genome, Genetics, and Genetic Mechanisms	0%		2%	
206	Basic Plant Biology	1%		2%	
211	Insects, Mites, and Other Arthropods Affecting Plants	16%		17%	
212	Pathogens and Nematodes Affecting Plants	21%		27%	
213	Weeds Affecting Plants	15%		3%	
215	Biological Control of Pests Affecting Plants	4%		15%	
216	Integrated Pest Management Systems	34%		12%	
304	Animal Genome	0%		2%	
305	Animal Physiological Processes	0%		1%	
311	Animal Diseases	1%		3%	
312	External Parasites and Pests of Animals	1%		3%	
402	Engineering Systems and Equipment	0%		1%	
721	Insects and Other Pests Affecting Humans	2%		4%	
722	Zoonotic Diseases and Parasites Affecting Humans	0%		2%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2017	Extension		Research	
	1862	1890	1862	1890
Plan	7.7	0.0	12.1	0.0
Actual Paid	7.4	0.0	11.1	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
1228821	0	1499088	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
1228821	0	1499088	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
25286720	0	64951954	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

UC ANR's integrated research and extension activities will conduct research projects, workshops, classes, and demonstrations, as well as one-on-one interventions. In addition, the programs will use PSAs, newsletters, mass media, web sites, and collaborations with other agencies and organizations to create and deliver programs.

2. Brief description of the target audience

- Farmers
- Ranchers
- Rangeland owners/managers
- Landscaping professionals
- Owners/operators of allied agricultural industries
- General public
- Crop and pest consultants

3. How was eXtension used?

UC ANR academics used eXtension to participate in and contribute to Communities of Practice, to answer "Ask an Expert" questions, and for other networking purposes.

V(E). Planned Program (Outputs)

1. Standard output measures

2017	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	93407	0	0	0

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year: 2017

Actual: 10

Patents listed

NOVEL KINASE-START GENE CONFERRING RESISTANCE TO PLANT DISEASE AND TRANSGENIC PLANTS COMPRISING IT

SYNERGY-BASED BIOCONTROL OF PLANT PATHOGENS

ENHANCED DISEASE RESISTANCE BY INTRODUCTION OF NH3

RNA SLENCING IN ANIMALS AS AN ANTIVIRAL DEFENSE

INSECT REPELLENT AND ATTRACTANTS

VIRUS DISCOVERY BY SEQUENCING AND ASSEMBLY OF VIRUS-DERIVED siRNAs, miRNAs, piRNAs

MOLECULES THAT INDUCE DISEASE RESISTANCE IN PLANTS

CITRUS GREENING (HUANGLONGBING) - INDUCED SAMLL RNAS ARE POTENTIAL EARLY DIAGNOSIS MARKERS

METHODS FOR ASSESSING REPELLANT QUALITY OF ORGANIC MATERIALS AND METHODS AND COMPOSITIONS FOR REPELLING ARTHROPODS

MOLECULAR METHOD FOR UNIVERSAL DETECTION OF CITRUS VIROIDS

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2017	Extension	Research	Total
Actual	105	346	451

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Classes/Short Courses Conducted

Year	Actual
2017	76

Output #2

Output Measure

- Workshops Conducted

Year	Actual
2017	100

Output #3

Output Measure

- Demonstrations and Field Days Conducted

Year	Actual
2017	30

Output #4

Output Measure

- Newsletters Produced

  Not reporting on this Output for this Annual Report

Output #5

Output Measure

- Web Sites Created or Updated

Year	Actual
2017	41

Output #6

Output Measure

- Research Projects Conducted

Year	Actual
2017	210

Output #7

Output Measure

- Videos, Slide Sets and Other AV or Digital Media Educational Products Created

Year	Actual
2017	31

Output #8

Output Measure

- Manuals and Other Printed Instructional Materials Produced

Year	Actual
2017	65

Output #9

Output Measure

- Popular Articles

Year	Actual
2017	108

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Farm, ranch, rangeland, and landscaping owner/operators and managers and allied industry professionals, participating in the programs, gain knowledge of pest management techniques, including Integrated Pest Management strategies.
2	Farm, ranch, rangeland, and landscaping owner/operators and managers and allied industry professionals, participating in the programs, adopt recommended prevention, detection and monitoring, and treatment practices for pest management, including Integrated Pest Management strategies.
3	Farm, ranch, rangeland, and landscaping owner/operators and managers and allied industry professionals, participating in the programs, realize lower costs for pest prevention and management.
4	Farm, ranch, rangeland, landscaping, and boat owner/operators and managers, allied industry professionals, and members of the public participating in the programs, gain knowledge of prevention, detection, and treatment strategies and techniques for management of invasive species.
5	Decreased incidence of endemic and invasive pests and diseases.
6	Farm and landscaping owner/operators and managers, and other allied industry professionals, participating in the programs, gain skills to detect, monitor, and treat endemic and invasive pests and diseases.
7	Research informed weedy rice regulations and growers adopted Best Management Practices.
8	Growers and pest control advisors adopted best management practices for sulfur use to control tomato powdery mildew.
9	Strawberry and vegetable growers' adoption of recommended practices resulted in economic gains.
10	Adoption of pest management practices for the Consperse stink bug reduces processing tomato crop losses and thus more economic gain for growers.
11	Public housing staff develop improved pest management strategies.

Outcome #1

1. Outcome Measures

Farm, ranch, rangeland, and landscaping owner/operators and managers and allied industry professionals, participating in the programs, gain knowledge of pest management techniques, including Integrated Pest Management strategies.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	3551

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Pathogens and Nematodes Affecting Plants
213	Weeds Affecting Plants
216	Integrated Pest Management Systems
312	External Parasites and Pests of Animals

Outcome #2

1. Outcome Measures

Farm, ranch, rangeland, and landscaping owner/operators and managers and allied industry professionals, participating in the programs, adopt recommended prevention, detection and monitoring, and treatment practices for pest management, including Integrated Pest Management strategies.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	852

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Pathogens and Nematodes Affecting Plants
213	Weeds Affecting Plants
216	Integrated Pest Management Systems
312	External Parasites and Pests of Animals

Outcome #3

1. Outcome Measures

Farm, ranch, rangeland, and landscaping owner/operators and managers and allied industry professionals, participating in the programs, realize lower costs for pest prevention and management.

Not Reporting on this Outcome Measure

Outcome #4

1. Outcome Measures

Farm, ranch, rangeland, landscaping, and boat owner/operators and managers, allied industry professionals, and members of the public participating in the programs, gain knowledge of prevention, detection, and treatment strategies and techniques for management of invasive species.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	711

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
135	Aquatic and Terrestrial Wildlife
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Pathogens and Nematodes Affecting Plants

213 Weeds Affecting Plants
216 Integrated Pest Management Systems
312 External Parasites and Pests of Animals

Outcome #5

1. Outcome Measures

Decreased incidence of endemic and invasive pests and diseases.

Not Reporting on this Outcome Measure

Outcome #6

1. Outcome Measures

Farm and landscaping owner/operators and managers, and other allied industry professionals, participating in the programs, gain skills to detect, monitor, and treat endemic and invasive pests and diseases.

Not Reporting on this Outcome Measure

Outcome #7

1. Outcome Measures

Research informed weedy rice regulations and growers adopted Best Management Practices.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Weed management is challenging in rice system. Rice weed control is complicated and expensive. One weed of current importance is weedy rice, also known as red rice. This weed is

the same genus and species as rice, and therefore not controlled by any of the rice herbicides available in California. In late 2016 infestations were estimated to be over 10,000 acres and present in all rice producing counties. This weed has the potential to be a significant problem, both reducing yield and quality.

What has been done
UCCE conducted research, outreach and education on rice weed management practices. Over 750 rice growers and Pest Control Advisers were trained in rice weed identification, management and herbicide resistance management. And over 1600 rice growers and Pest Control Advisers were taught how to identify, report, and manage weedy rice in California rice fields.

Results
California rice growers are actively implementing recommended Best Management Practices in their fields. 130 weed seed samples were submitted to the Herbicide Resistance Screening program during the 2017 season. There were 43 reports of suspected weedy rice infestations made by rice growers and Pest Control Advisers; this is a large increase from the previous season, when most growers were reluctant to report having an infestation. Results from the 2016 research and weedy rice survey informed changes to the California State Seed Certification Laws. Additionally as a result of this research, a new Quality Assurance (QA) program was put in place by the California Crop Improvement Association, to certify rice seed that cannot be certified in the normal seed certification pipeline. Both the changes to the seed law and the new QA program prevent the spread of new infestations of weedy rice. Thus, these efforts help decrease yield losses and maintain quality, and therefore have the potential for economic impact.

4. Associated Knowledge Areas

KA Code	Knowledge Area
213	Weeds Affecting Plants

Outcome #8

1. Outcome Measures

Growers and pest control advisors adopted best management practices for sulfur use to control tomato powdery mildew.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Tomatoes are one of California's top ten commodities, valued at $1.3 billion in 2016. Foliar diseases pose a significant threat to California tomato production in some cases reducing yields by 30 percent or more. The continued sustainability of this industry depends on the development and dissemination of research-based information on crop protection.

What has been done
UCCE engaged in collaborative research on the detection of fungicide resistant strains of tomato powdery mildew in California and the chemical control of tomato powdery mildew. UCCE educational programs extended best management practices for sulfur use to tomato growers, including specifically the recommended application of sulfur by ground equipment instead of by airplane/helicopter.

Results
Based on analysis of the California Department of Pesticide Regulation database, as of 2015 more acres are now being treated with sulfur, up 40% from 2006. This largely reflects the increase in disease pressure during that period and not UCCE educational efforts. However, in 2015 there was a greater use (up 26%) of sulfur dust versus spray-able sulfur in line with our recommendations that dust applications are more effective against powdery mildew than spray applications. In 2015 over 200,000 more acres were treated by the ground method than in 2006. These newly implemented ground applications of sulfur dust are not only more effective in controlling the disease, but they also greatly reduce the chance of off-target movement of sulfur into adjacent areas when compared with air applications. Thus, this UCCE work helped increase the adoption of best management practices for sulfur use contributing to improved air quality, acknowledging that the decision to dust or spray by ground is influenced by multiple economic and logistical factors.

4. Associated Knowledge Areas

KA Code	Knowledge Area
212	Pathogens and Nematodes Affecting Plants

Outcome #9

1. Outcome Measures

Strawberry and vegetable growers' adoption of recommended practices resulted in economic gains.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
About two-thirds of the country's fruits and nuts and about half of the country's vegetables are grown in California. California is the leading fresh market vegetable producing state. Strawberries are one of California's top ten most values commodities, valued at $1.83 billion in 2016. Strawberry and vegetable crops have a variety of pest and disease issues causing significant losses and increasing management costs. Conducting research to provide practical solutions to manage the pests and diseases and developing outreach material about new and existing issues is needed for the industries to remain productive and competitive.

What has been done
One UCCE project conducted a broad range of education activities over 2017, with around 650 attendees in total. There was a mite training, an annual strawberry field day, and a microbial control workshop at the Ag Innovations Conference. Training on entomopathogenic fungi and their identification was provided to laboratory personnel at Driscoll, one of the world's largest berry producers. Multiple educational presentations were provided to a broad range of clientele, from the Hispanic Vegetable Growers to California Association of Pest Control Advisers to participants at the Sustainable Ag Expo. The IPMinfo smart phone app was updated. Lastly, multiple print and broadcast interviews helped get the information out to clientele.

Results
Strawberry and vegetable growers on the Central Coast adopted recommended management practices that resulted economic gains. One grower implemented recommended pest and weed management practices and reported a 25% increase in yields on over 500 acres. Two other growers managing over 3000 acres reported economic increases based on adoption of recommended irrigation and nutrient management practices, from $800-100 increases per acre.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
211	Insects, Mites, and Other Arthropods Affecting Plants
213	Weeds Affecting Plants

Outcome #10

1. Outcome Measures

Adoption of pest management practices for the Consperse stink bug reduces processing tomato crop losses and thus more economic gain for growers.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
California produces over 10 million tons of processing tomatoes on close to 250,000 acres. The Consperse stink bug has reached damaging levels in California's processing tomatoes. Tomatoes that are damaged either completely decay, which reduces yields, or the damage is recorded as rot at the grading station.

What has been done
A UCCE project was initiated in 2014 to evaluate and find solutions to the pest issue. First an overwintering site was identified. In 2015 the insect was found in high populations in pheromone baited traps and insecticides applications were made to susceptible crops nearby. The study tested programs and insecticides with several modes of action. Several materials showed promise, but there was inconsistency over the two years of the study. Outreach and education events were conducted to provide research results and updates.

Results
Pest Control Advisors (PCA's), pest management consultants have adopted the use of pheromone-baited traps for early detection for about 25,000 acres. In 2016 and 2017, where these traps are being used, and where the consultants are careful about sanitation, crop losses were minimal. In contrast, where traps are not being used, and even in places where the stink bugs are generally less aggressive, this pest continues to be an economic issue.

4. Associated Knowledge Areas

KA Code	Knowledge Area
211	Insects, Mites, and Other Arthropods Affecting Plants

Outcome #11

1. Outcome Measures

Public housing staff develop improved pest management strategies.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Public housing developments accommodate thousands of people in California. Although these multi-unit buildings provide a safe environment for residents, they are not necessarily fully protected. Structural pests are often a major problem in multi-unit housings, as many of these units become invaded by cockroaches, bed bugs, fleas, ants, and rodents. Cockroaches have shown to be a cause for asthma and severe allergies for people. Also, bed bugs feed on human blood causing pain and emotional distress. As such, the presence of these pests can significantly reduce the quality of life for residents. Classical pest control methods significantly rely on pesticide use which can negatively impact human health, cause pesticide resistance in pests, and cause surface water pollution. Integrated Pest Management (IPM), on the other hand, employs a combination of methods, which focuses on monitoring, habitat manipulation, and physical and chemical control to reduce pest population while minimizing negative health and environmental risks. Implementing IPM can be challenging which makes training an essential part of every IPM program.

What has been done
The UCCE IPM advisor for Los Angeles County collaborated with the Northeastern IPM Center to conduct IPM training workshops for 90 people including housing managers, maintenance supervisors, and social workers in Santa Barbara and San Luis Obispo counties. The training included information about biology and management of the most important pests in structures such as bed bugs, Argentine ants, and German cockroaches. Different control methods for each pest were reviewed and discussed.

Results

The training has helped improve pest control practices. Housing managers, supervisors, and social workers gained new knowledge and are now able to make informed decisions regarding their pest control policies, identify advantages and disadvantages of various pest management methods, and encourage effective changes to the current pest control plans at their sites.

4. Associated Knowledge Areas

KA Code	Knowledge Area
211	Insects, Mites, and Other Arthropods Affecting Plants
216	Integrated Pest Management Systems

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Populations changes (immigration, new cultural groupings, etc.)

Brief Explanation

{No Data Entered}

V(I). Planned Program (Evaluation Studies)

Evaluation Results

UC ANR's quantitative and qualitative outcomes recorded from the evaluation studies are reported under the State Defined Outcomes section.

Key Items of Evaluation

The Report Overview's Federal Planned Program summary of accomplishments highlights UC ANR's most notable research and extension examples from FY 2017. In addition, under the Federal Planned Programs State Defined Outcomes section, the significant success stories are reported as qualitative outcomes.

V(A). Planned Program (Summary)

Program # 5

1. Name of the Planned Program

Water Quality, Quantity and Security

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
102	Soil, Plant, Water, Nutrient Relationships	4%		20%	
103	Management of Saline and Sodic Soils and Salinity	6%		1%	
104	Protect Soil from Harmful Effects of Natural Elements	0%		1%	
111	Conservation and Efficient Use of Water	39%		15%	
112	Watershed Protection and Management	31%		16%	
122	Management and Control of Forest and Range Fires	0%		1%	
123	Management and Sustainability of Forest Resources	0%		1%	
124	Urban Forestry	2%		0%	
131	Alternative Uses of Land	0%		2%	
132	Weather and Climate	0%		13%	
133	Pollution Prevention and Mitigation	13%		10%	
135	Aquatic and Terrestrial Wildlife	0%		3%	
201	Plant Genome, Genetics, and Genetic Mechanisms	0%		4%	
202	Plant Genetic Resources	0%		2%	
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants	0%		2%	
205	Plant Management Systems	1%		3%	
206	Basic Plant Biology	0%		3%	
403	Waste Disposal, Recycling, and Reuse	3%		0%	
405	Drainage and Irrigation Systems and Facilities	1%		0%	
605	Natural Resource and Environmental Economics	0%		3%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2017	Extension		Research	
	1862	1890	1862	1890
Plan	2.3	0.0	1.5	0.0
Actual Paid	2.5	0.0	0.6	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
573887	0	166758	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
573887	0	166758	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
7576750	0	17912917	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

UC ANR's integrated research and extension activities will conduct research projects, workshops, classes, and demonstrations, as well as one-on-one interventions. In addition, the programs will use PSAs, newsletters, mass media, web sites, and collaborations with other agencies and organizations to create and deliver programs.

2. Brief description of the target audience

- Governmental agencies
- Water managers
- UC campus-based water centers
- The general public
- Farmers
- Ranchers
- Agricultural organizations
- Owners/managers of private and public rangeland, forest, and wildlands

3. How was eXtension used?

UC ANR academics used eXtension to participate in and contribute to Communities of Practice, to answer "Ask an Expert" questions, and for other networking purposes.

V(E). Planned Program (Outputs)

1. Standard output measures

2017	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	38655	0	0	0

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year: 2017

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2017	Extension	Research	Total
Actual	35	69	104

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Classes/Short Courses Conducted

Year	Actual
2017	15

Output #2

Output Measure

- Workshops Conducted

Year	Actual
2017	28

Output #3

Output Measure

- Demonstrations and Field Days Conducted

Year	Actual

2017	5

Output #4

Output Measure

- Newsletters Produced
  Not reporting on this Output for this Annual Report

Output #5

Output Measure

- Web Sites Created or Updated

Year	Actual
2017	3

Output #6

Output Measure

- Research Projects Conducted

Year	Actual
2017	38

Output #7

Output Measure

- Videos, Slide Sets and Other AV or Digital Media Educational Products Created

Year	Actual
2017	2

Output #8

Output Measure

- Manuals and Other Printed Instructional Materials Produced

Year	Actual
2017	2

Output #9

Output Measure

- Popular Articles

Year	Actual
2017	9

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Farm, ranch, and rangeland owners/managers and allied industry professionals, participating in water quality education programs, gain knowledge of management practices for improving water quality.
2	Farm, ranch, and rangeland owners/managers and allied industry professionals, participating in water quality education programs, adopt management practices for improving water quality.
3	Farm owner/operators, allied industry professionals, and members of the public, participating in water conservation education programs, gain knowledge of water use and conservation practices.
4	Farm, ranch, and landscape owners/managers, and allied industry professionals and governmental agency representatives, participating in the programs, gain skills to conserve water and protect water quality.
5	Farm owners/managers, allied industry and natural resource professionals, and members of the public, participating in the programs, adopt of water conservation practices.
6	Science review informs decision-making on the role and state of groundwater modeling in sustainable groundwater management.

Outcome #1

1. Outcome Measures

Farm, ranch, and rangeland owners/managers and allied industry professionals, participating in water quality education programs, gain knowledge of management practices for improving water quality.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	135

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
133	Pollution Prevention and Mitigation

Outcome #2

1. Outcome Measures

Farm, ranch, and rangeland owners/managers and allied industry professionals, participating in water quality education programs, adopt management practices for improving water quality.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	490

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
133	Pollution Prevention and Mitigation

Outcome #3

1. Outcome Measures

Farm owner/operators, allied industry professionals, and members of the public, participating in water conservation education programs, gain knowledge of water use and conservation practices.

Not Reporting on this Outcome Measure

Outcome #4

1. Outcome Measures

Farm, ranch, and landscape owners/managers, and allied industry professionals and governmental agency representatives, participating in the programs, gain skills to conserve water and protect water quality.

Not Reporting on this Outcome Measure

Outcome #5

1. Outcome Measures

Farm owners/managers, allied industry and natural resource professionals, and members of the public, participating in the programs, adopt of water conservation practices.

Not Reporting on this Outcome Measure

Outcome #6

1. Outcome Measures

Science review informs decision-making on the role and state of groundwater modeling in sustainable groundwater management.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Federal and state interests are focused on how to more effectively use both surface and groundwater resources in the Sacramento Valley, so some of these water resources can be redirected from northern California to meet needs in other parts of the state. Regional and local efforts are focused on managing their existing water resources to assure long-term water needs are met locally and regionally before any water resources are transferred out of the area. Science-based knowledge is needed to inform policy-making and the management of groundwater and surface water resources of the Sacramento Valley.

What has been done
A collaborative team involving UCCE and several other agencies released the report "Assessment of Interconnected Subbasins" and conducted related outreach. The report describes the current state of groundwater modeling in California and includes, recommendations on the utility of current regional and local groundwater models for groundwater management planning and implementation; highlights limitations of current regional and local groundwater models for sustainable management; and recommends how governmental agencies should invest future resources to improve them.

Results

This report is being used to inform policy makers and water rights holders of the increasing role groundwater modeling will have in the next 25 years. This science-based information helps California as the state strives to manage groundwater in a more sustainable and coordinated manner.

4. Associated Knowledge Areas

KA Code	Knowledge Area
112	Watershed Protection and Management

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Populations changes (immigration, new cultural groupings, etc.)

Brief Explanation

{No Data Entered}

V(I). Planned Program (Evaluation Studies)

Evaluation Results

UC ANR's quantitative and qualitative outcomes recorded from the evaluation studies are reported under the State Defined Outcomes section.

Key Items of Evaluation

The Report Overview's Federal Planned Program summary of accomplishments highlights UC ANR's most notable research and extension examples from FY 2017. In addition, under the Federal Planned Programs State Defined Outcomes section, the significant success stories are reported as qualitative outcomes.

V(A). Planned Program (Summary)

Program # 6

1. Name of the Planned Program

Sustainable Energy

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
102	Soil, Plant, Water, Nutrient Relationships	0%		1%	
111	Conservation and Efficient Use of Water	0%		1%	
133	Pollution Prevention and Mitigation	0%		3%	
201	Plant Genome, Genetics, and Genetic Mechanisms	0%		6%	
202	Plant Genetic Resources	0%		7%	
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants	0%		7%	
204	Plant Product Quality and Utility (Preharvest)	0%		1%	
205	Plant Management Systems	0%		2%	
206	Basic Plant Biology	0%		21%	
212	Pathogens and Nematodes Affecting Plants	0%		4%	
302	Nutrient Utilization in Animals	0%		1%	
402	Engineering Systems and Equipment	0%		1%	
403	Waste Disposal, Recycling, and Reuse	0%		6%	
511	New and Improved Non-Food Products and Processes	0%		25%	
601	Economics of Agricultural Production and Farm Management	0%		3%	
603	Market Economics	0%		1%	
605	Natural Resource and Environmental Economics	100%		6%	
609	Economic Theory and Methods	0%		2%	
610	Domestic Policy Analysis	0%		1%	
723	Hazards to Human Health and Safety	0%		1%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2017	Extension		Research	
	1862	1890	1862	1890
Plan	0.4	0.0	2.8	0.0
Actual Paid	0.2	0.0	2.0	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
30662	0	456484	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
30662	0	456484	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
42116	0	6558666	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

UC ANR's integrated research and extension activities will conduct research projects, workshops, classes, and demonstrations, as well as one-on-one interventions. In addition, the programs will use PSAs, newsletters, mass media, web sites, and collaborations with other agencies and organizations to create and deliver programs.

2. Brief description of the target audience

- Relevant agency and private-sector partners
- Lawmakers working on issues related to energy
- Members of the public in general
- Agricultural producers of crops for use as biofuels

3. How was eXtension used?

UC ANR academics used eXtension to participate in and contribute to Communities of Practice, to answer "Ask an Expert" questions, and for other networking purposes.

V(E). Planned Program (Outputs)

1. Standard output measures

2017	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	0	0	0	0

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year:	2017
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2017	Extension	Research	Total
Actual	0	36	36

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Workshops Conducted

Not reporting on this Output for this Annual Report

Output #2

Output Measure

- Web Sites Created or Updated

Not reporting on this Output for this Annual Report

Output #3

Output Measure

- Research Projects Conducted

Year	Actual
2017	21

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Program participants gain knowledge about new improved methods related to producing sustainable energy.

Outcome #1

1. Outcome Measures

Program participants gain knowledge about new improved methods related to producing sustainable energy.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
{No Data Entered}

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
511	New and Improved Non-Food Products and Processes

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Populations changes (immigration, new cultural groupings, etc.)

Brief Explanation

{No Data Entered}

V(I). Planned Program (Evaluation Studies)

Evaluation Results

UC ANR's quantitative and qualitative outcomes recorded from the evaluation studies are reported under the State Defined Outcomes section.

Key Items of Evaluation

The Report Overview's Federal Planned Program summary of accomplishments highlights UC ANR's most notable research and extension examples from FY 2017. In addition, under the Federal Planned Programs State Defined Outcomes section, the significant success stories are reported as qualitative outcomes.

VI. National Outcomes and Indicators

1. NIFA Selected Outcomes and Indicators

Childhood Obesity (Outcome 1, Indicator 1.c)	
918	Number of children and youth who reported eating more of healthy foods.
Climate Change (Outcome 1, Indicator 4)	
0	Number of new crop varieties, animal breeds, and genotypes whit climate adaptive traits.
Global Food Security and Hunger (Outcome 1, Indicator 4.a)	
610	Number of participants adopting best practices and technologies resulting in increased yield, reduced inputs, increased efficiency, increased economic return, and/or conservation of resources.
Global Food Security and Hunger (Outcome 2, Indicator 1)	
0	Number of new or improved innovations developed for food enterprises.
Food Safety (Outcome 1, Indicator 1)	
0	Number of viable technologies developed or modified for the detection and
Sustainable Energy (Outcome 3, Indicator 2)	
0	Number of farmers who adopted a dedicated bioenergy crop
Sustainable Energy (Outcome 3, Indicator 4)	
0	Tons of feedstocks delivered.